SWEEP

SOIL AND WATER

ENVIRONMENTAL

ENHANCEMENT PROGRAM

PAMPA

PROGRAMME D'AMELIORATION

DU MILIEU PEDOLOGIQUE

ET AQUATIQUE

Canada

Ontario

SWEEP

is a $30 million federal-provincial agreement, announced May 8, 1986, designed to improve soil and water quality in southwestern Ontario over the next five years.

PURPOSES

There are two interrelated purposes to the program; first, to reduce phosphorus loadings in the Lake Erie basin from cropland run-off; and second, to improve the productivity of southwestern Ontario agriculture by reducing or arresting soil erosion that contributes to water pollution.

BACKGROUND

The Canada-U.S. Great Lakes Water Quality Agreement called for phosphorus reductions in the Lake Erie basin of 2000 tonnes per year. SWEEP is part of the Canadian agreement, calling for reductions of 300 tonnes per year — 200 from croplands and 100 from industrial and municipal sources.

PAMPA

est une entente fédérale-provinciale de 30 millions de dollars, annoncée le 8 mai 1986, et destinée à améliorer la qualité du sol et de l'eau dans le Sud-ouest de l'Ontario.

SES BUTS

Les deux buts de PAMPA sont: en premier lieu de réduire de 200 tonnes par an d'ici 1990 le déversement dans le lac Erie de phosphore provenant des terres agricoles, et de maintenir ou d'accroître la productivité agricole du Sud-ouest de l'Ontario, en réduisant ou en empêchant l'érosion et la dégradation du sol.

SES GRANDES LIGNES

L'entente entre le Canada et les États-Unis sur la qualité de l'eau des Grands Lacs prévoyait de réduire de 2 000 tonnes par an la pollution due au phosphore dans le bassin du lac Erie. PAMPA fait partie de cette entente qui réduira cette pollution de 300 tonnes par an — 200 tonnes provenant des terres agricoles et 100 tonnes provenant de sources industrielles et municipales.

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AN EVALUATION OF THE SOIL AND WATER ENVIRONMENTAL ENHANCEMENT PROGRAM

Prepared For

Agriculture Canada

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EXECUTIVE SUMMARY

Background

The Soil and Water Environmental Enhancement Program (SWEEP), a federal-provincial program designed to reduce the volume of phosphorus being transported to Lake Erie, consisted of seven sub-programs. The federal programs included: the Pilot Watershed Studies; the Technology Assessment Panel; the Conservation Information Bureau; and the Socio-economic Evaluation. Each sub-program was managed by a private sector contractor except the Socio-economic Evaluation.

The province of Ontario was responsible for: Local Demonstrations; Technical Assistance; and Soil Conservation Incentives. The two levels of government were jointly responsible for the Administration, Monitoring and Public Information sub-program.

SWEEP operated with the support and participation of four government ministries: Agriculture Canada; Environment Canada; the Ontario Ministry of Agriculture and Food; and the Ontario Ministry of the Environment.

The SWEEP objectives were:

1. To reduce phosphorus loading in the Lake Erie basin by 200 tonnes per year by 1990 from non-point agricultural cropland sources.
2. To maintain or improve the productivity of Southwestern Ontario agriculture by reducing or arresting erosion and other forms of soil degradation.

Evaluation Procedures

The evaluation was conducted using an evaluation framework consistent with procedures specified by the Office of the Comptroller General, Treasury Board of Canada. The data used to conduct the evaluation come from program reports and interviews with 10 program staff, 25 key respondents, 5 contractors and a survey of 427 farmers. A sample of 800 farmers from the SWEEP area selected by Statistics Canada were mailed a questionnaire. In addition to 327 who returned questionnaires, 100 were interviewed on the telephone by Statistics Canada staff.

Research Findings

The two major objectives were investigated utilizing 13 evaluation issues for which various research questions were developed. The major evaluation issues and conclusions are outlined below.

Phosphorus Loading

The issue of whether or not the target of reducing phosphorus loading in the SWEEP study area by 200 tonnes per year by 1990 was achievable with existing and technologies developed by SWEEP could not be resolved. The question was not answered because the Overview Model has yet to provide the necessary data and a decrease of that amount on over 400,000 hectares was next to impossible to achieve through conservation technologies alone.

It was found that while the phosphorus loading has been reduced in the SWEEP area, the 200 tonne per year objective was not met. Major measurement problems were experienced due to the lack of adequate rainfall events and the unavailability of the

results of a farm survey.

Effects of Conservation Practices

The conservation practices promoted by SWEEP had a positive input on the agricultural productivity of the area. The measurement of the overall impact on the area was dependent upon measures of the adoption of various tillage practices. These data are not yet available.

Economic Impact

The Farm Level Economic Analysis data demonstrated that conservation tillage is less risky, provides a larger net income and reduces the cost of soil erosion when compared to conventional tillage on individual farms.

Information Creation

The SWEEP research activities, plus activities of the Conservation Information Bureau and extension personnel, have both created and disseminated a substantial volume of conservation information to farmers. The levels of awareness of and knowledge about conservation practices by farmers have increased since 1986.

Attitudes

The attitudes of farmers to soil and water conservation are believed to have become more positive.

Impact of SWEEP

While it is difficult to demonstrate causality, it is believed that the program both increased knowledge and the adoption of conservation practices. Much of the information received by farmers comes from non-SWEEP sources who may be disseminating SWEEP generated research and other activities.

Research and Expertise

The program increased research activity and the capability of the private sector. Many consultants acquired or updated their research skills, new equipment was developed and farmers became much more active in conducting research on their own farms.

Unintended Effects

Few negative program effects were observed. There were unanticipated delays and difficulties in conducting the Pilot Watershed Studies. Several staff and key respondents commented that more information and greater cooperation occurred than anticipated.

Organization and Management

The organizational structure which consisted of several committees did not provide adequate information flow or control. The lack of a single individual who had overall authority for the program and who could provide timely decisions was discussed. The contracting out procedures proved controversial and some difficulties arose. Suggestions for improved management systems were made.

Cost Effectiveness and Changes

The program was found to be relatively cost effective given its innovative nature. A tighter management system and better communication might have increased efficiency. Concern was expressed regarding the opportunity to continue research in the Pilot Demonstration Watersheds and to utilize research skills developed during the program.

Conservation Information Bureau

The CIB component was evaluated in greater detail than the other program components at the request of the client. Flaws in and difficulties developing from the organizational structure and management procedures were identified. The control of the CIB was considered relatively weak due partly to the organizational structure and control procedures. It was determined that the CIB had created and disseminated a substantial volume of useful information. The adequacy of funding was discussed in view of a budget overrun.

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INTRODUCTION

Evaluation Background

The following evaluation was conducted under a contract awarded by Agriculture Canada. It was prepared during the final phases of the Soil and Water Environmental Enhancement Program, SWEEP, using procedures based upon the general approach approved by the Treasury Board of Canada (71). It utilizes, but is independent of, the design of an evaluation assessment and the completion of a farmer survey in 1987 by another evaluation consultant (69). The various acronyms and abbreviations used in this report are listed in Table 1.

The collection of data for the evaluation involved: a review of records, files and reports; interviews with 10 staff members; 25 knowledgeable experts (key respondents); 5 contractors; and a farmer survey. The individuals interviewed are identified in Appendix 1.

A mail/telephone survey was conducted with a sample of 800 farmers in the study area which includes the 12 counties listed in Table 1, Appendix 2, page 5. Statistics Canada selected a sample of farmers who had reported sales of $10,000 and over and had grown 40 or more hectares of grain crops in 1991. Three hundred and twenty-seven farmers returned useable questionnaires and 100 additional farmers were interviewed on the telephone by Statistics Canada staff.

The evaluation assessment, used to complete the study, drew upon the one completed in 1987, but the results of the earlier farmer survey, for reasons explained in the report, were not generally utilized to make direct comparisons. The results of the farmer survey are presented in Appendix 2.

Technical Background

The SWEEP initiative resulted from the Canada and United States 1978 Great Lakes Quality Agreement (GLWQA). In October 1983, Canada and the United States formally agreed to the Phosphorus Load Reduction Supplement to Annex 3. The supplemental agreement established a phosphorus load reduction target for Lake Erie of 11,000 tonnes/year and required the governments to further reduce annual loadings by 2,000 tonnes, 1,700 tonnes by the United States and 300 tonnes by Canada (55).

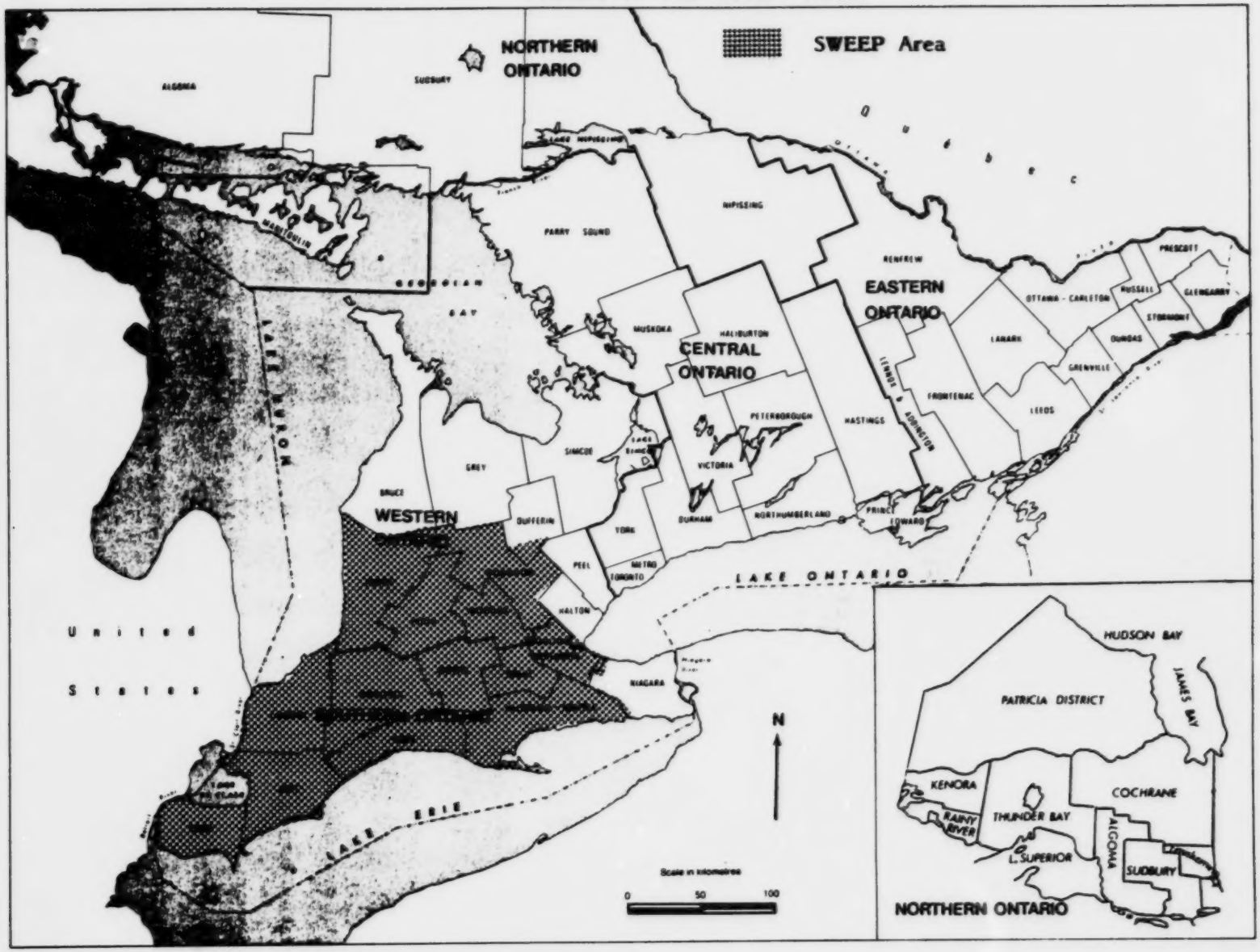
In Canada, the requirements of the Phosphorus Load Reduction Supplement have been implemented under the Canada-Ontario Agreement (COA). A Federal-Provincial task force examined the relative costs of control programs for all major sources of phosphorus including industrial, municipal, detergent, urban runoff, agricultural runoff and livestock.

The task force estimated that cropland sources of phosphorus to Lake Erie could be reduced by 200 tonnes through adoption of improved soil management and conservation practices on those farms located in priority drainage areas. This is in addition to a further 100 tonne reduction from municipal point sources in order to meet the 300 tonne Canadian target. The purpose of the SWEEP initiative was to achieve the phosphorus load reduction target for farm lands in the Lake Erie Basin. The SWEEP study area is shown in Figure 1.

Table 1. Program Abbreviations

AC	Agriculture Canada
COA	Canada-Ontario Agreement on Great Lakes Water Quality
CIB	Soil and Water Conservation Information Bureau component
EC	Environment Canada
EMMC	Environmental Monitoring and Modelling Committee Now called: Non-Point Source Management Committee (NPSMC) of COA
FLEA	Farm Level Economic Analysis component
GLWQA	Great Lakes Water Quality Agreement
LD	Local Demonstrations sub-program
MC	Management Committee
MTF	Modelling Task Force of the Non-Point Source Technical Sub-Committee (NPSTC) of COA
Overview Model	Non-Point Source Overview Model
OMAF	Ontario Ministry of Agriculture and Food
OMOE	Ontario Ministry of the Environment
OMNR	Ontario Ministry of Natural Resources
PWS	Pilot Watershed Studies sub-program Formerly Pilot Demonstration Watersheds
PI	Public Information component
SCI	Soil Conservation Incentives sub-program
SEE	Socio-Economic Evaluation component
SWEEP	Soil and Water Environmental Enhancement Program Initially, prior to and for a time after the formal agreement was signed in August 1988, it was called the Ontario Soil and Water Quality Enhancement Program.
T-2000	Tillage-2000 demonstration plots component (part of Local Demonstrations sub-program)
TA	Technical Assistance sub-program
TAP	Technology Assessment Panel component
TED	Technology Evaluation & Development component
WC	Working Committee

FIGURE 1. THE STUDY AREA



THE SWEEP PROGRAM

Organization

Overview

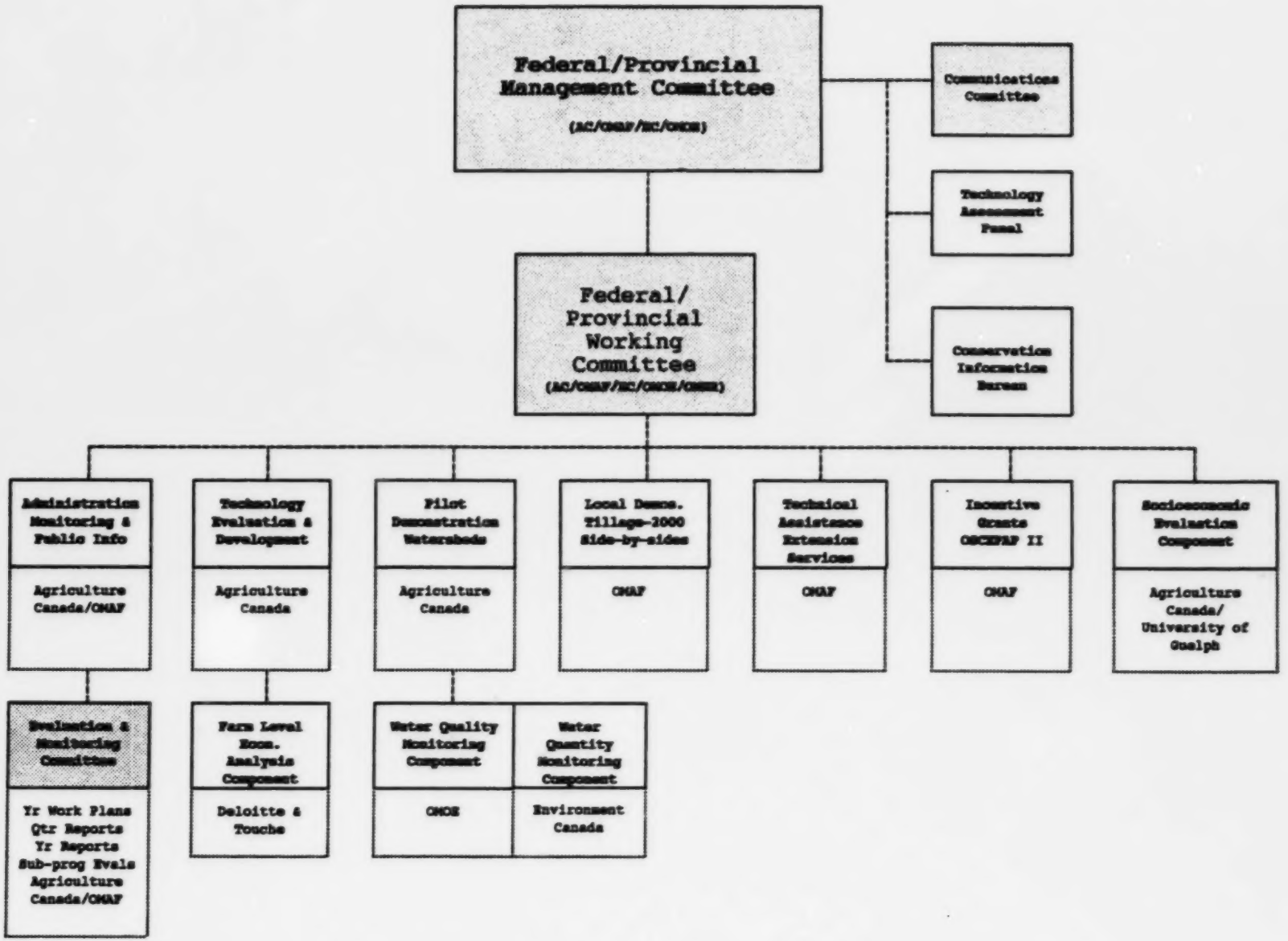
The program consisted of seven sub-programs. The federal government directed: 1) the Pilot Watersheds Studies (PWS); 2) the Technology Evaluation and Development project (TED); and 3) the Technology Assessment Panel (TAP), the Conservation Information Bureau (CIB) and the Socio-economic Evaluation (SEE). Each sub-program was managed by a private sector contractor except the Socio-economic Evaluation.

The province of Ontario was responsible for three programs, namely: 1) Local Demonstrations; 2) Technical Assistance; and 3) Soil Conservation Incentives. The two levels of government were jointly responsible for the Administration, Monitoring and Public Information sub-program.

SWEEP operated with the support and participation of four government ministries: Agriculture Canada (AC); Environment Canada (EC); the Ontario Ministry of Agriculture and Food (OMAF); and the Ontario Ministry of the Environment (OMOE).

The general structure of SWEEP is depicted in Figure 2. SWEEP was managed by several committees, the major two of which were the Management Committee and the Working Committee. No one individual was assigned authority and responsibility for the overall control and administration of the program on a day-to-day basis. This deficiency will be commented on later.

Figure 2. Organizational Chart for SWEEP



Management Committee

SWEEP was headed by a Management Committee composed of representatives from Agriculture Canada, the Ontario Ministry of Agriculture and Food, Environment Canada and the Ontario Ministry of the Environment. The Management Committee was responsible for overall management of the Agreement. Its purpose was to integrate and give overall direction to the federal and provincial projects that constitute SWEEP. Mr. Vern Spencer was the provincial Co-chairman of the Management Committee from 1986-1993. In January 1987, Mr. Glenn Gorrell replaced Mr. Nelson Ball as federal Co-chairman. He was replaced by Ms. Frances Cullen later that year who, in turn, was replaced by Ms. Sharon MacKay in 1992.

Working Committee

This Committee co-ordinated activities within SWEEP, overseeing all projects and generating reports for the Management Committee. This committee, which met on a quarterly basis, represented the same four ministries as did the Management Committee. Mr. Galen Driver was the provincial Co-chairman and Mr. Roger Thompson was the federal Co-chairman. Mr. Thompson was replaced later in the program by Mr. Fred Mooney, after the former's retirement. The seven sub-programs and their relationship are shown in Figure 2 and outlined in Appendix 3. The budget of each and their expenditures are summarized in Table 2.

Monitoring and Evaluation Committee

This Committee had representation from Agriculture Canada, the Ontario Ministry of Agriculture and Food, Ontario Ministry of the Environment, Ontario Ministry of Treasury and Economics and Environment Canada. An annual Progress Review of the Program was directed by the Monitoring and Evaluation Committee which is also responsible for this evaluation project.

Table 2. SWEEP Sub-Program Funding Allocations and Expenditures

Sub-Program	Federal Contribution	Provincial Contribution	Expenditure	%
1. Technology Assessment Panel (TAP) +				
Socio-economic Evaluation (SEE)			$ 598,200	2.0
Conservation Information Bureau (CIB)			$ 1,000,000	3.3
Sub-Total	$1,730,000	Nil	$ 1,598,200	
2. Technology Evaluation and Development (TED)	$6,800,000	Nil	$ 6,758,400	22.2
3. Pilot Watershed Study	$5,250,000	Nil	$ 5,165,300	18.6
4. Local Demonstrations	Nil	$1,750,000	$ 1,952,000	6.4
5. Technical Assistance	Nil	$6,000,000	$ 5,207,000	17.1
6. Soil Conservation Incentives	Nil	$7,000,000	$ 8,171,300	26.8
7. Administration, Monitoring and Public Relations			$ 1,092,800	3.6
Total			$29,945,000	100.0
Total Federal SWEEP Expenditures			$14,614,700	
Total Ontario SWEEP Expenditures			$15,330,300	

Program Objectives

In 1985, the Soil and Water Environmental Enhancement Program (SWEEP) was signed by the federal and provincial governments in order to achieve the 200 tonne phosphorus loading reduction from agricultural non-point sources. SWEEP was a $30 million joint federal-provincial program designed to:

a) reduce phosphorus loadings from cropland runoff in the Lake Erie Basin; and

b) improve productivity of Southwestern Ontario agriculture by reducing or arresting soil erosion that contributes greatly to water pollution.

Cropland sources of phosphorus to Lake Erie were to be reduced, by approximately 10%, through adoption of improved soil management and conservation practices. It was estimated that a 0.5 kg/ha reduction of total phosphorus over 400,000 hectares, approximately 30% of improved cropland in the Lake Erie Basin, would achieve the program objective (55).

The official SWEEP objectives in the Canada/Ontario Agreement on Great Lakes Water Quality were:

1. To reduce phosphorus loading in the Lake Erie Basin by 200 tonnes per year by 1990 from non-point agricultural cropland sources.

2. To maintain or improve the productivity of Southwestern Ontario agriculture by reducing or arresting erosion and other forms of soil degradation.

In order to achieve these overall objectives, the program focused on improving soil management and cropping practices. Intermediate objectives were established which related more directly to the seven program components. They do not mention the phosphorus reduction objective nor do they establish quantitative targets. These objectives were stated by in the Evaluation Assessment prepared by The DPA Group Inc. (70) as follows:

1. To increase awareness of soil and water quality issues within the farm community.

2. To change attitudes toward soil and water conservation practices.

3. To stimulate adoption and continued use of conservation practices.

4. To generate a base of knowledge which will support further introduction of conservation practices beyond the life of SWEEP.

EVALUATION PROCEDURES

Evaluation Framework

The evaluation framework draws heavily from an Evaluation Assessment prepared for Agriculture Canada by the DPA Group Inc in 1987 (70). The senior author of this report participated in the preparation of that report. The evaluation framework of this project was reviewed with the client, Agriculture Canada, prior to initiating the study. The evaluation issues were outlined according to the four basic categories of program evaluation issues specified by the Office of the Comptroller General, Treasury Board of Canada, 1981 (71). These are:

1. Program Rationale - Does the program make sense?
2. Objectives Achievement - Has the program performed as expected?
3. Other Effects and Impact - What has happened as a result of the program?
4. Program Design, Delivery and Effects - Were there better ways of achieving the results?

Data Sources

Most of the data and information came from reports and interviews with 10 program staff, 25 key respondents, 5 contractors and 427 farmers. See Appendix 1 for the list of persons, excluding the 427 farmers, who were interviewed. The questionnaire and the results of the farmer survey are presented in Appendix 2.

EVALUATION FINDINGS

Introduction

The evaluation of the two major objectives was conducted utilizing a series of 13 issues for which various research questions had been developed to construct the evaluation assessment. These issues and questions are considered and answered, and discussed in relation to each evaluation issue.

The Phosphorus Related Objectives

Introduction

The Modelling Task Force (MTF) was established under COA to assist the COA Review Board and COA agencies in monitoring and evaluating the effectiveness of SWEEP in meeting the phosphorus load reduction target. The Modelling Task Force developed the Non-point Source Overview Model (Overview Model), which is described in Reference 54, for that purpose.

The target of reducing the phosphorus load by 200 tonnes per year is small relative to total loadings in tributaries flowing into Lake Erie. Also, the annual variability in measured tributary loads exceeds the desired reduction. The Modelling Task Force decided to model the change in phosphorus loading from agricultural land in the Lake Erie Basin rather than measuring phosphorus loadings in its tributaries. The modelling approach adopted by the Modelling Task Force is a simple one, based more on accounting than on modelling. Conceptually, the modelling is actually a means of conducting a non-point source audit of the extent and effectiveness of control measures on sediment and phosphorus delivery.

The Overview Model relied on input data from extension, demonstration, incentive, research and monitoring programs to determine if the 200 tonne phosphorus load reduction target had been achieved. The Overview Model consisted of three main components: (1) Adoption; (2) Effectiveness; and (3) Extrapolation. The Adoption component provided quantitative data which reflected the degree of adoption of various conservation practices. The Effectiveness component provided the qualitative data which reflected the unit sediment-phosphorus reduction capability of the various conservation practices in relation to soil texture, landform, climate, etc. The Extrapolation component combined the results of (1) and (2) above and extrapolated the composite results to the Lake Erie Basin.

The primary source of data for the Adoption component was expected to be the OMAF Cropping, Tillage and Land Management Practices Surveys: 1986 and 1991 (60). Secondary data sources for this component were: OMAF 1987 Crop Residue Survey; the OMAF OSCEPAP Program; CIB-OMAF 1990 Survey of OMAF Extension Personnel; OMAF-OSCIA Land Stewardship Program; and Statistics Canada Agricultural Census Data for 1986 and 1991.

Data for the Effectiveness component were supplied by a number of sources at the micro-plot, plot, field, watershed and Great Lakes scales. The sources were: several TED reports (55); PWS sub-program (11); T-2000 (10); Tillage and Event Based Soil and Phosphorus Loss Report (75); OMOE Enhanced Tributary Monitoring Program; and the Kintore Creek Paired Watershed Study (1984-1987) (55).

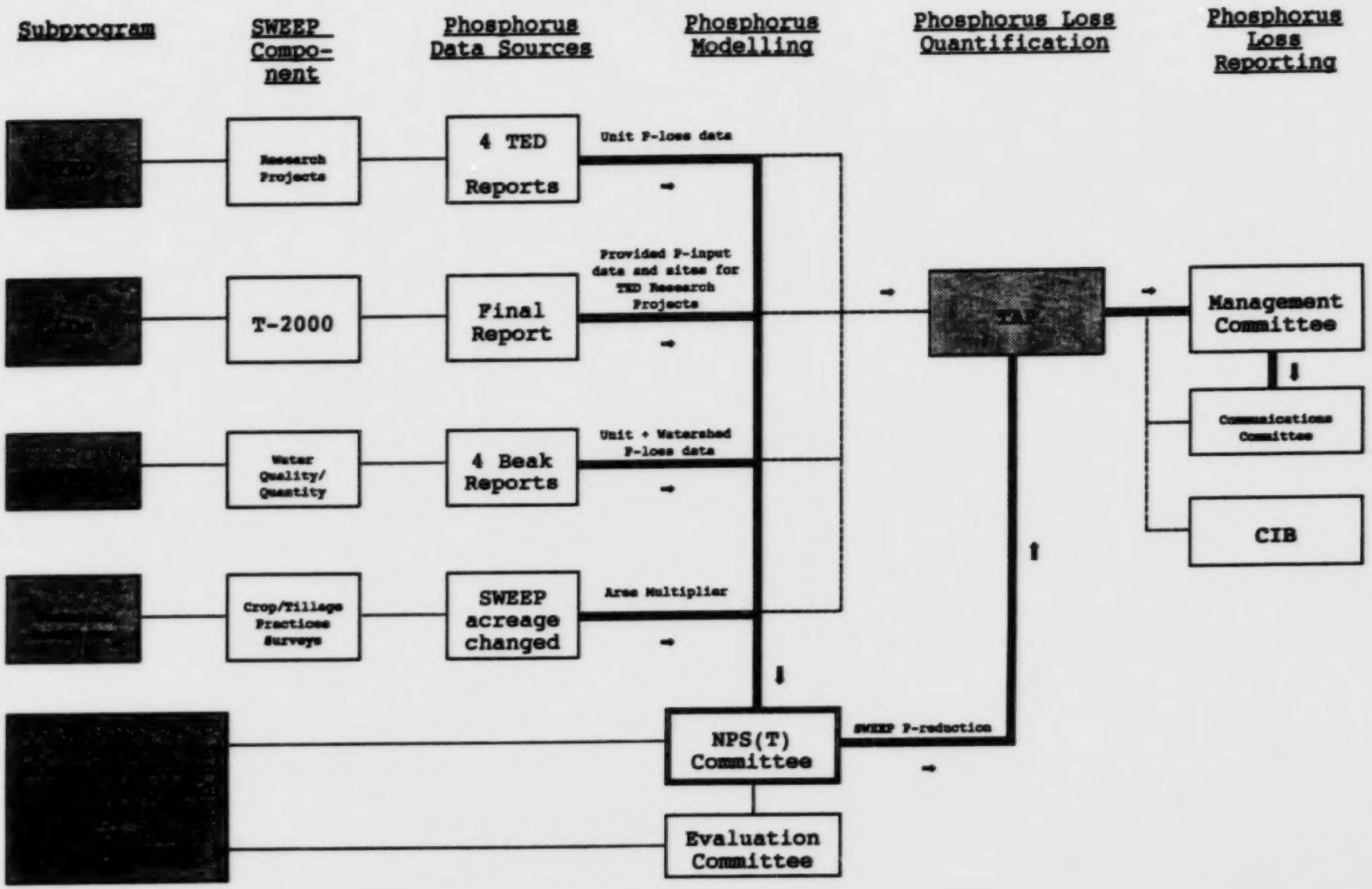
Evaluation

The SWEEP goals relating to the reduction of phosphorus were evaluated from two perspectives, namely, "Is the target of 200 tonnes per year reduction by 1990 achievable?" and "Have phosphorus loadings been reduced?". The procedures used to measure phosphorus and the resulting flow of the data collected are illustrated in Figure 3. SWEEP phosphorus loading data, or data which at least supported phosphorus loading calculations in the Non-Point Source Overview Model (Overview Model), were provided through the TED, LD and PWS sub-programs (55).

While the T-2000 project in itself did not produce specific phosphorus loading data, several project sites were used for TED research projects which did provide this information. However, T-2000 provided soil erosion loss data specific to soil texture, landscape position and tillage and cropping practice.

The PWS sub-program studied three paired watersheds, with each pair consisting of a Test and Control watershed. The adoption of soil and water conservation systems were encouraged and implemented on the TEST watersheds; landowners on the Control watersheds were encouraged to continue their conventional farming practices (13). Each of the three watershed pairs were equipped with a pair of environmental monitoring stations, including one at the Test watershed mouth (outlet) and one at the Control mouth. The instrumentation measured climatic factors, as well as water quantity and quality parameters (13). The paired watershed study design relied upon direct comparisons between the Test and Control areas as the primary method of environmental and agronomic evaluation. Data were collected at the whole watershed, farm, field and plot levels (11).

Figure 3. PHOSPHORUS LOSS DATA INPUTS AND MODELLING OF SWEEP AREA PHOSPHORUS REDUCTION



Phosphorus loadings were measured, over the program period, at the mouth of each watershed in the PWS sub-program (11). The sediment and phosphorus measurement techniques employed, especially in the PWS, were unique and developmental in nature. However, the procedures used were not generally well understood by many of the people interviewed by the evaluation consultant. Some respondents assumed that in the PWS areas, phosphorus loading could be directly measured and others knew, but did not understand how the measurements made at the mouths of the PWS watersheds would be utilized. Other respondents assumed that phosphorus levels would be directly measured at each watershed mouth.

Issue 1. Phosphorus Loading Target

Statement of the Issue: Was the target of reducing phosphorus loading by 200 tonnes per year by 1990 achievable?

1A. Best Available Technology

Evaluation Question: Can phosphorus runoff be reduced by 200 t/yr by implementing "best available conservation technology", that is, can it be reduced with technology which presently exists?

The target of reducing phosphorus delivery to Lake Erie by 200 t/yr was difficult to measure in the Lake Erie tributaries. It may have been measurable under a longer term program which would have provided more reliable data. However, the difficulty in measuring a 200 t/yr reduction in total phosphorus being delivered to Lake Erie relates to two problems: (1) in some years, less than 200 t/yr may be delivered from the Lake Erie Basin; and (2) OMOE's Enhanced Tributary Monitoring Program revealed that the standard error about the mean of the annual phosphorus loading estimate from the 17 Lake Erie tributaries can vary from 50 to almost 300 tonnes (55). The 200 t/yr target falls within this standard error range.

The objective of 200 tonnes per year required a reduction of 0.5 kg/ha/yr on 400,000 hectares. One TED report (27) indicates that for some crop lands, the maximum potential reduction in phosphorus loading possible under any tillage system may be significantly less than 0.5 kg/ha/yr. This report also indicates that techniques for measuring the total amount of phosphorus lost on an annual basis from field research plots are not well developed. A process for extrapolating from an event based monitoring system to annual phosphorus loads is also inadequately developed and risky.

The partial data set gathered indicates that the present range of annual phosphorus loss was in the area of 0.5 kg/ha to 2 kg/ha per year. Assuming that these figures are accurate, implementation of conservation technologies on some cropland will need to be very efficient at reducing phosphorus loss, if they are to result in an average of 0.5 kg/ha/yr reduction in phosphorus loading (27). While these figures may be accurate for some cropland, they are not representative of the total SWEEP area. Consequently, it is difficult to draw conclusions from the research. In addition, total phosphorus load reduction in the SWEEP area, derived from adoption rates for conservation practices and their site-specific effectiveness on only a sample of farms, remains inconclusive.

The PWS sub-program was conducted during a period when farmers were adopting new conservation practices and farming systems. Precipitation was also generally lower than average over the study period. In Southern Ontario, watershed scale studies usually require six complete cropping seasons, that is, 5.5 years to include 6 summers, in order to determine flow trends over time (13, 11). In addition, several extreme precipitation events or storms should be experienced in order to test the systems in place. As a result of these limitations, only trends in soil and phosphorus loss reduction due to conservation practices can be shown on a watershed basis (11).

Conservation tillage practices produced a reduction in phosphorus, but the results were not statistically significant (11). Although SWEEP's mandate was for "total phosphorus", the 200 t/yr level is very difficult, if not impossible, to measure. Excessive variance in the data at this level precludes accurate measurement. Consequently, no quantitative data are available at the watershed level to demonstrate the degree of phosphorus reduction achieved on the PWS watersheds (11). Thus, while the phosphorus runoff level was reduced using existing technologies, there is no firm evidence to determine whether the existing technology was capable of achieving the objective.

1B. New Technologies

Evaluation Question: Can the goal of reducing phosphorus loading by 200 tonnes per year be achieved using new technologies?

None of the research reports reviewed demonstrated that phosphorus loading can be consistently reduced by the target level of 200 tonnes per year over the total SWEEP area (13, 27, 11, 75). Some researchers, using plot and field scale data, reported reduced levels of soil and particulate phosphorus transport due to conservation practices, which may result in phosphorus loading reductions near the target level (11, 10). In some years of below normal rainfall, the phosphorus reduction level may be lower than 200 tonnes without any change in technology.

Studies in SWEEP and elsewhere show that soil cover - 30% or more residue cover on the soil surface after planting, coupled with a dense crop canopy, is the single most effective means of reducing soil erosion (11). Although the effect of soil cover was well understood prior to SWEEP, the SWEEP projects enhanced the understanding of soil and phosphorus movement, as well as the special problems associated with conservation tillage on finer textured soils (61, 10).

Discussion

The target of reducing phosphorus loading by 200 tonnes per year by 1990 may have been considered achievable at the beginning of the SWEEP program. However, now that the SWEEP program is completed, there is reason to doubt the achievability of this target. As one TED report (27) indicated, an average 0.5 kg/ha/yr phosphorus load reduction over 400,000 hectares was next to impossible to achieve through conservation technologies alone, on some crop lands. We cannot definitively answer this evaluation question for three reasons: (1) the Overview Model has yet to produce data which may answer this question; (2) sustainable cropping programs, which include more judicious application of phosphorus fertilizer, may result in significant phosphorus load reductions; and (3) many questions remain unanswered as to the phosphorus loading contributions of both applied manure and residue cover.

Issue 2. Reduction in Phosphorus Loading

Statement of Issue: Has the phosphorus loading been reduced in the SWEEP study area during the period of the program?

2A. Phosphorus Loading Levels

Evaluation Question: What were the levels of phosphorus loading in 1986 and 1990?

The PWS reports (13, 11) indicate that the lack of rainfall events required to sufficiently test the effectiveness of conservation tillage practices during the study period precluded collecting statistically valid phosphorus loss data. In addition, the output data from the Overview Model were not available at the time of writing.

The Task Force (55) collected and compiled unit area loading data for suspended sediment and total phosphorus from all published agricultural water quality studies undertaken in Southern Ontario. Analysis of the data revealed that a nonlinear relationship exists between the phosphorus enrichment ratio and unit area suspended sediment load. However, the data linkages among the various scales, e.g. micro-plot, plot, field, watershed and Great Lakes, are complex and not well understood. These complexities have thus far prevented an accurate assessment of the magnitude of the phosphorus load reduction to Lake Erie attributable to SWEEP.

At the time of writing, the quality of the data from the OMAF Cropping, Tillage and Land Management Surveys presented operational problems for the Overview Model. Data problems notwithstanding, the researchers agree the 200 tonne phosphorus load reduction objective was not achieved through conservation tillage and cropping practices (55).

2B. Land Management Practices

Evaluation Question: How have changes in land management practices affected phosphorus loading from the SWEEP area?

The question of whether or not and, if so, what changes in land management practices have affected phosphorus loading from the SWEEP area was addressed by the PWS (13, 11) and TED (27) sub-programs, and indirectly by the T-2000 project (10). Some TED studies showed that conservation tillage reduced soil erosion and, in turn, particulate phosphorus (27). However, no-till practices on clay soils resulted in less infiltration and greater runoff which contained higher levels of soluble phosphorus, even though little sediment and particulate phosphorus were present. Hence, the total phosphorus runoff was still lower than on areas where soil erosion occurred (27, 61).

SWEEP studies (73, 27, 75) revealed, that over the long term, comparisons of no-till and conventional tillage across a range of soil textures consistently indicated that the no-till resulted in lower infiltration rates and higher runoff. Although runoff was higher in the no-till, total soil loss and total phosphorus loss were both lower. These effects were consistent across measurements taken in spring, summer and fall and on different degrees of slope.

In the PWS sub-program (13, 11, 41), the overall objective of the conservation practices comparisons was not to statistically compare yields, but rather to show reduced sediment and phosphorus loadings as a result of conservation tillage practices. Yield data were collected mainly for the benefit of the cooperators. Cover, which includes residue and crop canopy, was shown to reduce runoff loadings of Total Suspended Solids (TSS) and Total Phosphorus (TP) at the watershed, field and plot scales (13, 11). These trends are not statistically significant, but coincide with higher crop residue levels in the Test watersheds. The results are quite important, in light of the fact that these studies were conducted during a period when farmers were changing their cropping practices. More dramatic improvements are likely as soil quality and increased farmer confidence and knowledge occur (11).

In the PWS watersheds, plot scales showed a reduction in phosphorus transport for conservation tillage practices, but the results are not statistically significant. In addition, researchers reported that field scale measurements of phosphorus transport resulted in too complex a data set to perform a statistical analysis, and the problem was further compounded for the watershed scale data set (13, 11).

2C. Reduction in Phosphorus Loading Due to SWEEP

Evaluation Question: What reduction in phosphorus loading can be attributed to SWEEP?

The attribution of effects to specific causes is logically challenging, especially when the effect being measured (phosphorus load reduction) exhibits a high degree of variability. To prove SWEEP was responsible for a specific percentage of the reduction in phosphorus loading to Lake Erie is extremely difficult, especially in the absence of accurate rate of adoption data for soil conservation practices in the SWEEP area.

A review of the total tonnes of phosphate fertilizer sold in Ontario from 1988 to 1992 indicated a reduction from 117,563 to 93,025 tonnes, which is 21%. Given this reduction in phosphate applications which undoubtedly would have occurred in the SWEEP area as well, a reduction in phosphorus loadings would be expected.

We consider any reductions in phosphorus loadings from the SWEEP area during the program period an achievement, attributable to both SWEEP and OMAF and Ontario Soil and Crop Improvement Association stand-alone programs. We believe that SWEEP gave impetus to other related conservation tillage initiatives.

Discussion

The phosphorus loading has been reduced in the SWEEP study area during the period of the program, but the target level of reduction was not achieved. The PWS showed that cover reduced runoff loadings of both sediment and phosphorus, but the associated data only indicated this as a trend. Although TED showed that conservation tillage reduced soil erosion and, in turn, particulate phosphorus, it did not demonstrate that the 200 tonne per year objective was met.

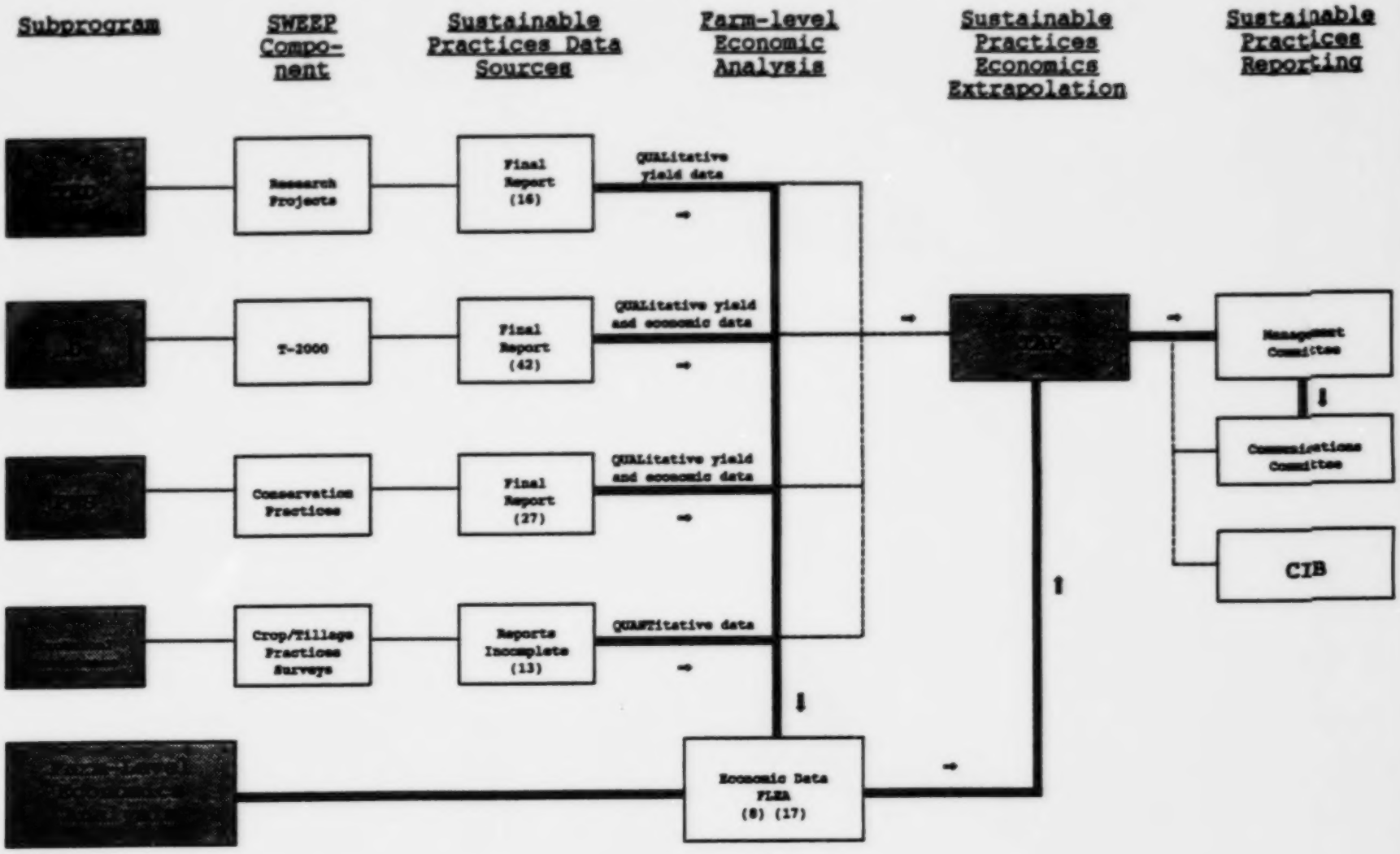
During the SWEEP program time frame, lack of rainfall events precluded statistical assessment of phosphorus loading in the PWS. More rainfall events were required to sufficiently test land management practices and, in turn, measure their effectiveness in reducing phosphorus loading. Further, data linkages among various measurement scales remain complex and cannot yet be quantified. Finally, the quality of data from the Adoption component of the Overview Model was less than expected.

The Productivity Objective

Introduction

The second SWEEP objective related to maintaining or improving the productivity of agriculture by controlling erosion and soil degradation. A data flow diagram, Figure 4, outlines the source of productivity data for this part of the program. Qualitative data reflected the impact of conservation practices on crop yields, soil quality, erosion and other forms of degradation. The quantitative data assessed the cost-effectiveness of conservation practices to both the farmer and to the environment. Eleven research issues were developed to evaluate the extent to which this objective was achieved. No specific quantitative objectives were established by the COA for this part of the SWEEP program.

Figure 4. DIAGRAM OF DATA FLOW RELATING TO SUSTAINABLE PRACTICES



Issue 3. Impact on Productivity

Statement of Issue: What has been the impact of SWEEP on agricultural productivity as measured by yields, soil quality, erosion and other forms of degradation?

3A. Effect of Conservation Practices

Evaluation Question: Have conservation practices slowed water runoff and reduced soil erosion and, if so, how?

Although SWEEP quantitative data were not statistically significant at the watershed level, plot scale data consistently showed reduction in both soil loss and total phosphorus transported on areas under conservation tillage (42, 60, 62). The PWS also showed similar benefits from conservation practices other than conservation tillage, for example, engineering structures such as water and sediment control basins (62). We are convinced that SWEEP encouraged conservation practices, slowed water runoff and reduced soil erosion, but the extent of these reductions are unknown.

On poorly drained soils, such as finer textured clays, studies showed that conservation tillage effectively reduced soil erosion, but not necessarily phosphorus transport (27, 61). On these soils, transport of soluble phosphorus was higher from conservation tillage than from conventional, indicating that conservation tillage may result in increased phosphorus bioavailability, that is, soluble phosphorus in surface residue, and reduced water quality (27, 61). One study indicated that the transport of total phosphorus, that is, sediment phosphorus plus dissolved phosphorus, also increased with conservation tillage, but further research is required to confirm this (27). Thus, if the SWEEP phosphorus objective is to be met, conservation tillage systems on some soils may need to be modified.

It is well known that soluble or dissolved phosphorus is more bioavailable and therefore causes more pollution to watercourses. Also, it is the soluble phosphorus that determines algae growth. Only the total phosphorus and soluble phosphorus are monitored and measured. While no-till increases soluble phosphorus runoff, it decreases particulate phosphorus runoff, resulting in an overall net benefit (27, 61). Particulate phosphorus, attached to soil particles, is by far the most significant component of total phosphorus. Hence, reduction of soil erosion through conservation tillage and other conserving practices markedly decreases total phosphorus loss (27, 61). Soluble phosphorus on the soil surface, e.g. from residue cover, is subjected to movement by runoff. However, soils with higher infiltration rates produce less runoff. As a result, more soluble phosphorus on the surface of these soils moves downward into the root zone where much of it becomes available to the crop.

The PWS watershed evaluations mainly focused on cover, that is, residue and plant canopy, as a measure of the degree of adoption of conservation tillage systems (41). Late in the study, cover in the Test watershed exceeded cover in the Control watershed by an average of 17%. Although conservation tillage practices produced greater runoff, they created less soil erosion, and therefore less particulate phosphorus transport. However, conservation tillage practices produced more soluble phosphorus, likely due to the residue itself (13, 11).

3B. Conservation Practices and Soil Quality

Evaluation Question: Have conservation practices affected soil quality and, if so, how?

Soil quality refers to factors such as organic matter, infiltration, soil tilth, compaction, etc. The SWEEP program time period was too short to determine the ameliorative effects of conservation practices on soil quality. Soil conservation studies have

demonstrated that soil tilth, infiltration and organic matter content often require several years to show a marked improvement (27, 11). SWEEP data indicated that conservation tillage systems may be more buffered against adverse climatic conditions during the growing season, than conventional tillage systems (27).

One TED study (72) revealed that erosion by tillage operations alone is a major cause of the severe soil loss observed on upper slope areas in the complex topography of upland regions of Southwestern Ontario. Although confined to the slope area, soil loss by tillage operations which move soil downward on these slopes, is considerably higher than soil loss by water. Total field scale soil loss was found to be negligible because concave lower slope areas gained all of the soil lost on the convex upper slope areas. Significant soil redistribution is occurring within the complex topography of Ontario, which is unrelated to the off-field transport of sediment, phosphorus and other chemicals (72). This suggests the assumption, that crop productivity losses from erosion and the environmental effects from erosion are linked, is not valid (72).

3C. Conservation Practices and Crop Yields

Evaluation Question: Have conservation practices sustained or improved crop yields and, if so, by how much?

The T-2000 study (10) indicated that, in general, yields for corn, soybeans and small grains showed no significant differences between conservation and conventional tillage systems. On sandier soils, > 36% sand, significantly higher yields resulted from no-till compared to conventional tillage. On finer textured soils the no-till yields were, on average, lower than for conventional tillage systems. Further research is required to improve conservation tillage yields on clay and clay loam soils (10).

Discussion

This evaluation issue involves ascertaining what impact SWEEP has had on the agricultural productivity of the study area. We conclude that SWEEP had a significant positive impact on the agricultural productivity of the study area. The extent of this positive impact is difficult to measure in the absence of adoption data which indicate the extent of adoption of conservation tillage practices in the SWEEP area.

Issue 4. Economic Impact

Statement of the Issue: What has been the economic impact of conservation techniques in terms of farm income?

4A. Changes in Costs and Revenues

Evaluation Question: Have conservation practices resulted in decreased costs and/or increased revenues?

One of the initial misconceptions regarding conservation farming was that, because it did not increase yields, it was not more efficient. Farmers tend to be more aware of and dedicated to increasing yields than reducing costs. Conservation tillage, by reducing equipment inventories, tractor power and the number of times a field is tilled, reduces costs. Eighty percent of the staff interviewed said conservation practices resulted in decreased costs and forty percent said that they resulted in increased revenues. Thirty percent did not believe revenues increased with minimum or no-till and the remainder did not know.

Conservation farming practices, such as no-till and minimum till studied under TED and T-2000, appear to be at least revenue neutral (24, 27, 10). The practices tested did not result in any significant yield reductions when compared to conventional practices. The conservation practices did not result in any significant increase in capital or input costs when compared to conventional farm practices (24, 10). The experience of many farmers indicates that the adoption of conservation farming practices can reduce input costs while maintaining yields, thereby improving the net returns to the farmer (24).

The Farm Level Economic Analysis (FLEA) component relied heavily on the T-2000 component for valid cost data, because the farmer data in the PWS was incomplete and unreliable. From the FLEA, it is clear that the profit per acre using reduced tillage or no-till is greater than the profit using conventional tillage practices (24). The benefit of soil conservation is particularly large when one considers the net return to labour and management. For example, for three of the four rotations studied, both reduced tillage and no-till net returns exceeded conventional tillage by $20 to as much as $110 per hectare.

A risk assessment of corn production was conducted by the FLEA consultant using the T-2000 data over the period of 1986 to 1989 (24). The results indicated that no-till systems present no greater risk than conventional tillage practices. Therefore, risk expectations of conservation tillage should not be an impediment to adoption.

At the watershed level, FLEA indicated varied optimum solutions for crop rotations (24). In the Kettle Creek and Pittock watersheds, the optimum solution is to use conservation tillage practices in a continuous corn cropping program. In the Essex watershed, conventional tillage provided the maximum net income for a "soybean-corn-soybean" rotation.

The study (24) indicated that exclusive use of conservation tillage practices on farmland which is subjected to high levels of erosion, could have a major positive impact on soil loss compared to conventional tillage, without having to set aside land or reduce profits. Thus, the cost of minimizing soil loss is lower under conservation than conventional systems. However, the foregoing does not consider the capital investment required in switching to conservation equipment.

A macro-economic analysis indicated that the economic benefits obtained from a 10% reduction in soil erosion are around $2.89 per hectare (24). A 40% overall reduction in soil erosion would increase the estimated downstream benefits to $11.84/ha. These benefits are likely somewhat understated, since a part of the impact was not quantifiable. For example, evaluations of the financial cost of soil erosion to wildlife, habitat regeneration, and natural aesthetics are unavailable, so the benefits of reduced sedimentation were not calculated.

4B. Changes Due To SWEEP

Evaluation Question: What changes in net income are attributable to SWEEP?

We were unable to estimate what changes in the net income of area farmers are attributable to SWEEP because we do not have a measure of the changes in cropping practices. This was to be provided by the 1986-1991 Cropping Tillage & Land Management Practices Study (60), which was not completed as of the date of this report.

Discussion

The economic impact of conservation tillage on either the watersheds or the SWEEP area has not been calculated by the research funded under this program. The FLEA demonstrated that conservation tillage is less risky, provides a larger net income and reduces the cost of soil erosion, when compared to conventional tillage on individual farms.

Issue 5. Information Base Produced

Statement of the Issue: Has the program produced a useful and reliable information base on conservation farming practices?

5A. Information Created

Evaluation Question: What information has been created?

The exact number of technologies tested and/or evaluated as the result of SWEEP is impossible to determine because there is no way of documenting the activities of all the farmers who participated. The TED program report indicates that 53 research projects were funded by that component of SWEEP. Forty percent of the projects were awarded in response to formal Request For Proposals and the remainder were awarded as the result of Unsolicited Proposals. The projects are listed in the bibliography and may be recognized by the designation SWEEP Report #61 (27).

The Socio-economic Evaluation component financed seven research projects on various aspects of technology transfer, an annotated bibliography of socio-economic soil and water conservation research and of conservation tillage equipment. These are identified in the bibliography.

Research projects were also completed for the Tillage 2000 demonstration plots as part of the Farm Level Economic Analysis component. The Monitoring and Evaluation Committee sponsored three reports on tillage and management practices, a survey of farmers for the Evaluation of SWEEP and a survey of crop residue.

The SWEEP research activities have made a major addition to the knowledge available to farmers who want to adopt conservation practices. The focus of the research has been on providing information which can be used by farmers, rather than on basic research. A number of articles were published in refereed journals, but no system had been established for recording these publications.

5B. Information Usefulness

Evaluation Question: Is information comprehensive and reliable? Can it support generalized recommendations?

The question of whether the information produced is comprehensive and reliable was investigated with the staff and key respondents. Nine of the ten staff interviewed said "yes, the program created a useful and reliable information base". Four of the nine believed that the program has definitely created a useful and reliable information base and five qualified their affirmative response by saying the results were reliable but not always in a practical form for farmers use. They said: the data had to be integrated with other study results and some, but not all, sub-programs were successful; they were not sure about the effectiveness of the Conservation Information Bureau in disseminating the information; and one said it was not as good as hoped. While two did not answer, two noted that the data was farm specific and thus its generalizability was unknown.

The key respondents generally perceived the information created to be useful and reliable. Over one-quarter said the information was both. Sixty percent qualify their answers by questioning its availability and its generalizability because some of the studies were not well designed. The T-2000, PWS and TED studies were mentioned as being very good by about one-fifth of the respondents. The general impression is that many respondents gave uncertain responses because they had not yet seen all the studies.

The usefulness of much of the research has been demonstrated by its inclusion in the Best Management Practices Manual which includes booklets on Soil and Water Problems, Livestock and Poultry Waste Management, Field Crop Production, Horticulture Crops and Farm Forestry and Habitat Management. Further titles are in progress.

5C. Availability of Information

Evaluation Question: Is information readily available?

Forty percent of the key respondents generally believe that conservation information, but not necessarily SWEEP information, is available from the CIB or County Extension offices. About one-quarter emphasize that the information is not easily acquired or they are unsure of where it is located. Overall, the key respondents appear to be saying "yes, the information is available, but I have not seen it or I think I know where it is supposed to be, but I am unsure". Several mentioned that the study reports and SWEEP fact sheets are not yet in the public domain or have not been distributed. There is an implied sense of frustration at the time required for their distribution.

With respect to availability of information, the staff echoed the sentiments of the key respondents. Two-thirds emphasized that information is available through a wide range of agencies and media, but one-third emphasized the difficulty in accessing it. They give one the sense that the information dissemination process is incomplete but they are hopeful it will improve.

As noted in the last section, the SWEEP research findings and information from other sources is presently being used to prepare a series of publications on Best Management Practices. A series of factsheet type summaries are near completion for the TED and some other SWEEP projects which will be available to extension personnel.

Over three-fifths, 62.0%, of the farmers when asked if they had adequate information about soil and water conservation programs and practices said they did. When asked if they would like additional information, almost half, 46.7%, said they would. We do not perceive it is inconsistent for a farmer to initially indicate he or she has adequate information and to later say they would like more.

The types of information desired are shown in Table 6, page 16, of Appendix 2. The types of information most frequently desired were: information regarding reducing pesticide use, 19.4%; reducing fertilizer use, 19.2%; conservation tillage and planting, 17.1%; tile drainage improvements, 15.0%; tree planting, 14.0%; maintaining over 20% residue cover, 13.6%; and ditch and stream bank protection, 10.8%.

The farmers would prefer to get their information about conservation practices from: OMAF Soil Conservation Advisors/Soil and Crop Advisors, 45.4%; Other OMAF staff, 34.6%; OMAF/Ag Canada publications, 33.8%; and other farmers, 22.1%.

5D. Contribution to Adoption

Evaluation Question: To what extent has the information base contributed to adoption of conservation practices or attitudes towards these practices?

Three-fifths of the staff respondents believed that the information created by the SWEEP program contributed to positive attitudes and increased adoption. Some of the comments were: SWEEP has been Ontario's best source of information; the communication plans and the resources that were put into it generated hype; there was increased use of conservation equipment; and T-2000 has identified and resolved several conservation tillage problems. Two respondents felt that exposure came through the media and advertising and two believed that SWEEP only contributed partially with other programs and factors contributing.

Two-fifths of the key respondents agreed that SWEEP created positive attitudes which resulted in adoption of conservation practices. Their comments include: many farmers have incorporated conservation practices into their farming systems; farmers gained access to SWEEP information through Innovative Farmers Meetings; and from personal observations. Seven of the key respondents felt that the SWEEP information contributed slightly or not at all to the adoption of conservation practices or attitudes towards these practices and three thought that extension staff and advisors were very helpful.

The extent to which the SWEEP information base has contributed to the adoption of conservation practices is very difficult to establish. Given the fact that relatively little information directly derived from the SWEEP research activities has been disseminated and the innovation process usually involves several years, it is premature to draw conclusions.

Discussion

The SWEEP research activities plus the work of the CIB have both created and disseminated a substantial amount of conservation information to farmers. The information has, by design, been applied in nature and has been used by farmers to adopt new practices and technologies. The diffusion of information on new farm practices is a slow process. The SWEEP generated information has had a visible impact on relatively few farmers to date, but this is to be expected because much of the information base has only started to be released in the Best Management booklets and Factsheets.

These reports are based upon applied research conducted in Ontario. The fact we now have an Ontario data base is important both for its applicability and its credibility among farmers. The participation of a substantial number of farmers in creating the data base, via T-2000, Side-by-Side, PWS and other field level studies, should not be underestimated. The credibility of research results is critical to their use by farmers.

Issue 6. Changes in Awareness

Statement of Issue: This evaluation issue investigates the extent to which both awareness of soil and water quality issues and their relative importance have increased among farmers.

6A. Awareness Levels

Evaluation Question: Has awareness of soil quality and water quality issues increased?

The 10 staff and 25 key respondents surveyed were asked whether or not a need existed in 1986 to increase awareness of soil and water issues among farmers. All 35 respondents interviewed said a need existed at that time.

The majority, 7 of the 10 staff, said that in 1986, farmers were unaware or uninformed about the soil and water problems they were causing. Three staff said the farmers were at that time aware of soil problems, but did not understand the amount of phosphorus being transported or the effects of phosphorus down stream.

All of the 25 key respondents, when asked if a need existed to increase awareness in 1986, said it had. The reasons given for a need were: the lack of awareness or the lack of understanding of the problems then existing; the phosphorus loadings were high; the practices being used caused soil to degrade and to be lost; and farmers change only if they are shown practical alternatives and economic benefits.

The majority, 60%, of the staff and 88% of the key respondents, believe that in 1992 a need still exists to increase farmer awareness. Six of the staff state that some farmers are still unaware, while the other four state that the awareness level is adequate. Several staff made a distinction between awareness of soil issues and water issues. They also mentioned the need for more awareness of environmental issues which go beyond soil and water and a willingness for farmers to accept responsibility for their activities.

Almost one quarter of the key respondents said the need to become informed still exists because it is continuous. Other key respondents mentioned that: some had wrong perceptions of how to farm; change is just beginning to occur; and many still use traditional practices. About one-fifth believe awareness is adequate especially among younger farmers and two believe farmers are saturated with information on environmental issues.

The awareness of farmers regarding various soil and water conservation issues was not directly investigated, but levels of use of 18 practices and awareness of 10 SWEEP programs were determined. The results of these questions are reported in Appendix 2, Question 15 and 12 respectively and discussed in the next section.

We cannot document the effects of the Conservation Information Bureau publication InfoSOURCE on farmer adoption, but believe it has been positive.

While we do not have precise pre-post measures of awareness of soil and water quality issues, we consistently were told by interviewees that awareness had increased. The existence of the SWEEP programs, especially those components such as Tillage 2000 and the Side-by-Side programs, made farmers aware of conservation tillage. A number of field days and conferences on reduced or no tillage have received widespread media coverage. We conclude that awareness of both soil quality and water quality issues has increased as the result of SWEEP activities.

6B. Knowledge of Conservation Practices

Evaluation Question: Are farmers more knowledgeable about conservation practices?

The question of whether or not farmers are more knowledgeable about conservation practices is closely related to their awareness. The distinction between awareness and knowledge may be useful when explaining adoption behavior, but is extremely difficult to document in the field. Since it is quite difficult to measure farmers' knowledge, we have imputed it from the number of farmers utilizing practices. Knowledge is considered a prerequisite for adoption.

Approximately two-fifths of the farmers interviewed in 1992 who said they were using one or more of 18 conservation practices said they had began doing so since 1986. The average present level of use of the 18 practices asked about in Question 15, see Appendix 2, was 32.1% and 12.9% had begun since 1986. In effect, two-fifths, on average, had begun using the practice since 1986. We believe this implies both an increase in knowledge and the development of positive attitudes.

Three-fifths, 62%, of the farmers surveyed reported that they have adequate information about soil and water conservation programs and practices. A high proportion of farmers, 83.3%, claimed they consider soil conservation and water quality issues when developing cropping and tillage plans. This indicates both awareness and knowledge of conservation issues and practices. The percentage of farmers considering conservation issues or effects when doing farm planning were as shown in Question 10B, Appendix 2. The ones most frequently considered were weed control, 60.8%; crop yields, 60.2%; costs involved, 57.1%; potential erosion, 48.7%; soil compaction, 45.8%; and manure application, 40.6%.

Discussion

While we cannot quantify the increase in level of conservation knowledge among farmers since 1986, we are convinced that the level of knowledge has increased, but as discussed in Section 6A, a need still exists to educate more of the farmers. Some of the key respondents were convinced many farmers, especially the younger ones, now have enough knowledge, but have not adopted for other reasons.

It is noteworthy that when asked why they had not adopted one of the innovations or practices they had considered, Question 16A of the Farmers' Questionnaire, the most frequently cited reason was lack of money. Almost four times as many of the 210

farmers involved said money prevented their adoption as a lack of information about the practice.

Issue 7. Attitude Change

Statement of the Issue: Have the attitudes of farmers towards conservation practices become more favourable?

The evaluation issue relating to a change in attitudes toward conservation practices was initially phrased in terms of the conservation ethic. Our review of the literature indicates the widespread use of the term "conservation ethic", but no operational definition of this hypothetical construct was found. In the absence of an available measure, we asked the key respondents about the need to change attitudes and to encourage the adoption of conservation practices. We asked the farmers about the importance of reducing soil erosion and runoff as proxies for their attitudes. Attitudes cannot be accurately measured with single statements. The development and validation of attitude scales which could be used in a mail survey of farmers was beyond the scope of this evaluation.

7A. Importance of Issues

Evaluation Question: Has the perceived importance of soil and water quality issues changed?

The farmers surveyed indicated that they believe it is important for Ontario farmers to reduce the amount of soil erosion and runoff. The importance was measured by having the farmers score four statements on a scale ranging from a low of 1 to a high of 5. They were instructed to score each in terms of its importance in reducing soil

erosion and runoff. Their average scores for the four criteria were as follows: a) the productivity of their own farms, 4.30; b) the environment in general, 4.26; c) the cost of drainage ditch maintenance, 4.10; and d) neighbouring farms, 4.02, see Question 9, Appendix 2. The data suggest they believe that all four are important, but the productivity of their own farm rates highest. In 1986, the farmers surveyed by The DPA Group Inc. (69) were asked to score all of the criteria, except the one regarding drainage ditch maintenance. Their average score for the three items was 3.43 compared to 4.19 for the farmers studied in 1992. The importance of soil erosion to farmers appears to have increased.

Another measure of importance is whether or not soil conservation and water quality issues are considered when developing cropping and tillage plans. Among the 1992 farmers surveyed, 83.3% said they did so and one-sixth, 16.7%, said they did not. In 1986, less than one-third, 30.7%, said they considered soil and water conservation issues when they plan their farm budget for a new year. While the questions are not identical, the increase in the percentage of farmers considering soil conservation and water quality in their planning is quite large.

7B. Acceptance of Conservation Practices

Evaluation Question: Is there greater acceptance of conservation practices?

The acceptance of conservation practices can be considered in terms of attitudes or behaviours. We assume a positive attitude is necessary but not sufficient for adoption, thus changes in attitudes are discussed first, then changes in behaviour.

Of the 25 key respondents, 84% said there was a need in 1986 to change attitudes toward soil and water conservation practices. The remaining 16% did not reply or said they did not know. All of the staff members said a need to change attitudes existed at the beginning of SWEEP.

The reasons cited by the key respondents and staff for a need to change attitudes towards conservation practices were: farmers tended to consider only the economics, farmers believed that yields were reduced, more chemicals were required and weed problems were greater; many farmers were following a production philosophy of larger fields, more power, etc.; farmers were unaware of the impact of erosion; some would not admit they had problems; and others were reluctant to change until they saw the results demonstrated.

The same numbers of key respondents and staff who believed a need existed in 1986 say a need still exists for farmers' attitudes to change. Over three-quarters of the respondents stated, in a variety of ways, that many farmers are still sceptical or need convincing that conservation farming works. Some farmers are believed by key respondents to still be unaware of the available solutions, to think erosion is a problem on other people's farms and to be unwilling to risk making changes.

One-quarter, 24.8%, of the 210 farmers who had considered but not adopted at least one specific conservation practice indicated they were not yet convinced it will work, 11% believed it may be too risky, 11.4% are still testing the practice and 8.6% were unsure they can operate or manage it properly. We believe that if such a proportion of the survey respondents still have questions and concerns about conservation practices, that within the general farm population, conservation attitudes are still in need of further improvement.

The attitudes of the farmers in the three Pilot Watershed Studies were studied using a number of data collection techniques (45). The primary research technique utilized personal interview surveys of all cooperators in June 1988 and again in January 1991 and January/February 1992. Qualitative data were collected by the technicians in May 1989 and November 1991 and case studies in April 1992.

The primary findings regarding perceptions of the extent of on-farm erosion and water quality in the sub-watershed drain were:

1. The farmers in all three test areas compared to the control areas reported a slightly lower level of perceived erosion.
2. The control area farmers reported a slight increase in erosion over time.

The attitudes of farmers were investigated using six statements. The "control" and "test" watersheds were compared pre-post from 1988 to 1992, but no comparison was made for control vs test watersheds. Most differences cited were quite small.

The factors influencing decisions to continue use or to quit using conservation practices were also investigated. In all three test watersheds, the proportion of total factors which are positive or encouraging of conservation practices was lower in 1992 than 1991. This was explained in terms of participants expectations being subjected to reality. The research results make it difficult to draw conclusions about the farmers' attitudes because perceptions and adoption received almost as much attention as attitudes. The measurement of attitudes in a field situation is quite difficult. The researchers used single statements or items rather than developing and validating scales or indices.

Discussion

We conclude, based upon the research reviewed and comments of key respondents and staff, that attitudes toward soil and water conservation have become more positive in the past six years even though reliable measures are generally not available. The reasons for the changes in attitudes are believed to be:

1. Increased awareness of the extent of the problem in terms of soil loss and water degradation as the result of substantial research by SWEEP and other government agencies. Fewer farmers can deny the existence of a problem.
2. Increased awareness of both problems and solutions as the result of widespread media coverage of conservation issues.
3. Greater awareness that the net returns from conservation farming are very similar to conventional practices even if yields do not increase. Most farmers are more production than business oriented. Emphasis has been on how to produce more bushels of crop rather than maximizing net income. Thus, acceptance of conservation tillage has required a major change in mind set among many farmers.
4. Attitudes change as the result of good experiences. Farmers who have participated in programs, such as Tillage 2000 and the Land Stewardship program, have become less sceptical and more willing to adopt other practices as they observe the results of trials both on their own and neighbours farms.

Issue 8. The Impact of SWEEP

Statement of Issue: To what extent can changes in awareness of, knowledge about and attitudes toward and changes in land management practices be attributed to SWEEP?

This evaluation issue is very difficult to answer directly because it is always hard to demonstrate causality. Further, farmers get much of their information from secondary sources, such as the farm press or extension personnel, and may thus not realize the information is based upon SWEEP research or communication activities.

8A. Awareness of SWEEP

Evaluation Question: Are farmers more aware of soil and water quality issues as a result of SWEEP?

Two-fifths, 40.5%, of the farmers interviewed in the SWEEP area indicated they were aware of the program name. Only 22 out of the 427 farmers could correctly identify the meaning of the acronym SWEEP. Both awareness of and correct identification of the program name increased as the total farm sales increased. Of the 166 who said they had heard of SWEEP, almost all, 161, were able to indicate at least one source from which they had heard of the program. The major sources, as shown in Question 11C, Appendix 2, were: farm press, radio or TV, 36.0%; soil conservation or soil and crop improvement advisors, 27.9%; OMAF or Ag Canada publications, 25.5%; an Ontario Soil and Conservation Improvement Association Land Stewardship Committee, 22.4%; and other farmers, 19.9%.

We had anticipated that the awareness of SWEEP programs might be low or farmers would confuse the many conservation programs and would not know which were and which were not part of SWEEP. We asked the farmers whether or not they were aware of and participated in a series of programs, see Question 12A, Appendix 2, for all the responses. The results are summarized below.

Program	Aware Of		Participated In		Ratio Aware/
	%	Order	%	Order	Particip
Farm Tours	52.0	1	21.8	1	2.5
Conservation Information Meetings	44.3	2	18.5	2	2.2
Tillage 2000	33.5	3	5.2	6	6
InfoSource Newsletter	30.2	4	11.5	3	2.5
Conservation Practices Surveys	29.7	5	8.9	5	3
OSCEPAP II	28.8	6	11.0	4	2.5
Pilot Demonstration Watersheds	26.5	7	2.8	7.5	9
Side-by-Side Demonstrations	23.2	8	2.8	7.5	8
TED - Technology Evaluation & Development	5.7	9	0.5	9.5	11
TAP - Technology Assessment Panel	4.0	10	0.5	9.5	8

Farm tours was the only program of which half the farmers were aware. For most SWEEP components, approximately one-quarter to one-third of farmers were aware. Only a small minority, 4-6%, were aware of TED and TAP. This is quite understandable because they were not programs the average farmer could apply for or participate in directly. The level of participation in the various programs was quite low except for farm tours and Conservation Information Meetings which is a generic description of various farmer information meetings.

Reasons stated by the farmer for not participating in the programs were: not aware, 36.3%; not useful on my farm, 22.2%; did not have enough information, 17.3%; too expensive, 9.8%; too late, 9.1%; and too much effort, 6.3%. Over half of the responses related to inadequate information.

When asked if they were aware of OMAF advisors who could provide assistance to farmers with conservation practices, 70.3% claimed they were aware of this service and almost one-third, 31.1%, had obtained information or assistance. This level of participation is much higher than the level of participation in other SWEEP programs

such as farm tours and conservation information meetings. Note that of the 132 who obtained information or assistance, three-fifths, 62.1%, listened to the advisor at a meeting, almost as many, 56.8%, received printed information from the advisor, two-fifths, 40.9%, had a farm visit and one-fifth, 21.2%, received on-farm help from the advisor with a conservation practice. Knowledge of conservation practices was discussed in Section 6A and 6B.

8B. Attitudes Toward Conservation Practices

Evaluation Question: Has SWEEP changed farmers attitudes toward conservation practices?

The direct impact of SWEEP on the adoption of soil and water related practices by 427 farmers interviewed was quite limited. Of the farmers adopting 18 conservation practices since 1986, only a minority began because of SWEEP. For exact percentages, see Question 15, Appendix 2. On average, 13% of all farmers adopting a practice since 1986 did so because of SWEEP, see Question 15, page 13, Appendix 2. The proportion crediting adoption to SWEEP ranged from a low of 2.2% for grassed waterways to 15.4% for erosion control structures. Note these percentages indicate the proportion of farmers who began using the practice since 1986 who did so because of SWEEP. See Section 5D for details of the responses of key respondents and staff.

Discussion

The indirect impact of SWEEP research and information activities on the adoption of conservation practices is difficult to document. Many of the farmers who are now employing conservation practices may have learned of the practice from an extension person or the mass media without knowing the source of the practice. The longer term impact of SWEEP on conservation practices cannot be known for many years.

Issue 9. Research and Expertise Stimulated by SWEEP

Statement of the Issue: The issue relates to whether or not SWEEP had an incremental impact on the research and development of personal expertise in soil and water conservation.

9A. Increased Research Activity

Evaluation Question: To what extent has research activity increased?

There is prima facia evidence that research activity increased. A large number and a wide range of research projects were completed. Under the TED program, over 53 research projects on a wide variety of soil and water problems were completed. The Pilot Watershed Study component was a field experiment on an unusually large scale and the first of its kind in Ontario. T-2000 provided the first field scale research data for conservation systems in Ontario. The project demonstrated that a field scale research design would work, establishing credibility among both farmers and researchers. Research projects were completed on sediment and phosphorus loadings as well as agronomic factors by the two contractors, Beak Consultants and Ecologistics Ltd. Deloitte & Touche also conducted studies to ascertain the economic implications.

The Socio-economic Evaluation (SEE) component stimulated the completion of theses by graduate students and the preparation of an annotated bibliography of socio-economic soil and water conservation research by Ecologistics Limited. On the basis of the financial data available, it is quite difficult to estimate the actual amount spent on research separate from administration or the production of extension materials.

In terms of developing soil and water conservation expertise, the staff believed the program made a significant contribution. Five said that considerable or a tremendous amount of expertise was developed. Three said some expertise was developed. Examples cited included: the development of a computer model; increased competitiveness in the supply industry; an increase in the number of soil and water consultants; the OMAF staff are more attuned to conservation tillage practices; manuals and guidelines have been developed; conservation farm plans are being considered; and farmers developed expertise at all levels. Another benefit mentioned was increased involvement and awareness of conservation issues by the media.

9B. Private Sector Capability

Evaluation Question: To what extent has private sector capability in soil and water conservation issues changed?

When the SWEEP program was developed, priority was given to having research projects completed by private firms. While consistent with government sourcing policy, it should have been realized that many of the research skills required were not widely available in the private sector. A very high percentage of biological research done in Ontario on agronomic problems had previously been financed by OMAF and Agriculture Canada and completed by the University of Guelph, the Colleges of Agricultural Technology or at Agriculture Canada research stations.

The 10 staff respondents were asked to what extent the program contributed to the development of new products or practices by the private sector. The majority referred to the development of new tillage equipment in general terms, such as indicating it became more available. It was noted that machinery companies were moving to conservation tillage type equipment, on-farm modifications were made and the

development of equipment by Ron Prong and Jack Rigby was mentioned. Two staff referred to the development of erosion control materials and structures, such as filter cloths and sediment basins. Three staff noted that the chemical industry had not kept pace with conservation tillage needs.

The final report of the TED sub-program (27) stated that, of the 53 research projects conducted, 31 had important technology development components. These ranged from new planting equipment to optimal herbicide systems.

Discussion

There is no doubt that the SWEEP program has substantially increased the private sector capability in the research area. Much smaller, but still significant, increases in capabilities have also occurred in the farm machinery industry. The capability of farmers to both diagnose and solve problems has also increased. A substantial number of private sector consultants have acquired new research skills which are available to complete future research assignments.

Issue 10. Unintended Effects

Statement of the Issue: Has there been any unintended results of the program?

The staff, when asked about unintended results of SWEEP, generally responded by indicating that the program had achieved more than they expected. This may be a measure of their low expectations. There was a perception that the program had pulled together the players, including five government ministries, conservation authorities, private firms and farm organizations. SWEEP demonstrated that they could work collectively and proved that problems can be solved on a cooperative

basis. The government agencies may have given up some control, but the effects on government programs were positive. One person felt there was some rivalry between agencies over funding.

The staffs' perceptions of unintended private sector effects were that the industry became more knowledgeable in that it provided information of use to the drainage industry and seed and fertilizer companies who wanted to participate in increasing farmers awareness of their services.

They believed an unanticipated effects was the creation of a larger information base which focused research on farm conservation systems and expanded to practices which increased organic matter, improved soil structure and reduced input costs. One staff member expressed the concern that promoting minimum and no-till may lead to the excessive use of pesticides.

The staff said the effects on the farm community were to increase cooperation among farm organizations, the creation of a greater awareness of conservation farming than anticipated, and the establishment of closer relationships between researchers and innovative farmers. In summary, it appears the program demonstrated the benefits of working together by government agencies, farm organizations and researchers.

Discussion

Few negative unintended effects were identified other than significant delays in beginning the PWS component and some conflicts regarding what and how data were collected. There were significant delays in completing the results of some surveys particularly the Cropping, Tillage and Land Management Practices in Southwestern Ontario follow-up study for 1991.

Issue 11. Organizational Structure and Management

Statement of the Issue: Were the organizational structure and management systems appropriate to the delivery of the program?

11A. Overlap and Complementarity

Evaluation Question: Did sub-programs overlap/complement each other? Were activities coordinated?

The many sub-programs and components were adequately defined so that there was limited overlap. The components were designed to compliment each other, but difficulties arose because of program staging. The programs operated by OMAF were, by and large, programs which were in place before the SWEEP program agreement was signed in 1986. They were completed in 1990 and 1991 while the Agriculture Canada program activities continued until 1993 because of a delay in starting the Agriculture Canada program.

Staff respondents noted, in varying ways, that the research and practices being identified and reviewed by TAP and being conducted by TED were frequently not available in time for use by the OMAF conservation advisors. This resulted from the delay in signing of a contract for the PWS component. They also mentioned that: the commitment of farmers to conservation farming may have started to fade when the financial incentives programs ended; the resource use was less efficient; and the PWS studies were only in the field three rather than five years. In reality, only three years of reliable data were available. In their final report, the TED contractors state "Tillage 2000 was an extremely important resource for the TED program, and losing access to Tillage 2000 field sites and expertise part way through was a serious impediment" (27).

11B. Organizational Structure

Evaluation Question: Was the organizational structure too complex?

The organizational structure, shown in Figure 2, illustrates the four committees responsible for the management and direction of SWEEP. The SWEEP program was directed by committees rather than by individuals who were responsible for the various components. This basic difference from the operating structure of most organizations had significant implications for the management of SWEEP.

The majority of staff, when asked if the organizational structure made it difficult to achieve the program's objectives, said it did not. The minority who said a problem existed, stated the organization was top heavy, had too many committees and there were problems in getting research reports completed and disseminated. Suggestions for improvements included: getting a consensus among governments and ministries on what was to be done; more clearly defining committee responsibilities, reducing their number and improving communication.

The adequacy of the communication among the various committees and the people responsible for the various program components was investigated with the 10 staff respondents. Forty percent said there was adequate communication. The remainder made the following comments: the modelling and monitoring committees, which include members beyond SWEEP should have been official committees; the communication was adequate, but people were not aware of the "big picture"; people and committees were confused as to their roles; there was a need for better review of what happened and what was in the data base; and there was a problem getting early data because some was not received until three years into the program.

Suggestions for avoiding the problems included: more cross linkage between Agriculture Canada and OMAF; a less complex and bureaucratic process; and streamlining of the organizational structure.

It is our judgement, supported by the minority of the staff and the majority of the five contractors interviewed, that the organizational structure created delays, frustration and inefficiencies. Throughout our evaluation, we were continually reminded that very few staff or key respondents were aware of all the program components or understood their relationships. There was a tendency for staff and key respondents only be knowledgeable of those programs they were actively involved with.

In our opinion, the organizational structure did not encourage or allow strong day-to-day control. Committees are an effective means of making policy decisions, but are not an appropriate means of operational control. Delays are inevitable if decisions must be made by committees which meet on a monthly basis. We suspect that the involvement of two levels of government and several ministries meant that a diffuse, collegial style decision system was preferred. Responsibility for mistakes is less easily ascribed with such a system.

The use of an individual scientific authority to oversee each of the various components is an appropriate means of maintaining the scientific quality of research projects but not necessarily the best means of managing a project with a large number of components especially when they extend over several years. It was suggested by a contractor that, in future, a training program on contract and project management should be provided to persons designated as scientific authorities.

We believe the program would have benefited from the designation of a single program administrator, with at least one assistant, who would have been solely

employed directing SWEEP. This would have provided greater decision making continuity and quicker decisions. Surely a $30 million program warrants at least one overall full-time manager.

11C. Information Flow

Evaluation Question: Did the program structure optimize the flow of information to various staff, target groups and the farming community?

The question of the effect of the organizational structure was considered from the perspective of staff members in the previous section. Fifty percent of the staff said that the program structure optimized the flow of information. Three respondents thought that the flow of information was fine; one said there were problems in obtaining data since some sub-programs did not start to flow until 3 years into the program; one that it was hard getting up-front data for use later on; and one that there were communication problems especially with the Conservation Information Bureau and the Management Committee.

We were very aware of delays in the completion of reports when completing this evaluation. We understand the phosphorus modelling exercise was delayed until data from the cropping, tillage and land management practices tillage survey undertaken in 1991 was recently made available. The final report for this project was not available when this evaluation was completed.

Several studies promised to the evaluation consultant for the fall of 1992 were not available until February and March 1993, making an extension of this evaluation necessary. Whether one can attribute these delays to the organizational structure, the individuals involved or staff changes is questionable. We believe a more rigorous

control system with a central administrator would have hastened the flow of information.

11D. Contracting Out

Evaluation Question: How successful were contracting out activities?

The federal strategy of contracting out the management of PWS, TED, TAP and the Conservation Information Bureau and the research activities of TED was controversial. The University of Guelph and some Colleges of Agricultural Technology staff opposed the policy of contracting out research. Over time and with changes in the representation of Agriculture Canada on the Management Committee, the policy of limiting research contracts to private companies or individuals was abandoned.

The most obvious examples of a change in policy was the Conservation Information Bureau for which the principal evaluation consultant prepared an initial organizational design with the implicit instructions that it should be privately operated and become self-sufficient over time (79). Subsequently, the Bureau was established under a contract with the University of Guelph in what appears to have been an effort to provide greater funding to the University.

The policy of having work contracted out to the private sector was consistent with long standing federal policy of Supply and Services Canada. It was not surprising that difficulties arose because there were only a very limited number of agronomic researchers available in the private sector to bid on and conduct much of the proposed research. There were adequate economic, communication, evaluation and environmental consultants and engineers to complete the desired projects, but specific expertise in areas such as hydrologic/phosphorus modelling were not as widely available.

The attempt to actively involve farmers in the research contracting process was commendable but respondents report frustrations due to a lack of the farmers understanding of the bidding process, research standards and their failure to meet deadlines. The contracting, as opposed to the research granting process, has many advantages in terms of conducting applied research because of the greater control on both activities and deadlines. The fact that very little basic research was funded was a source of complaint from university professors. The TED final report (27) indicates that 45.6% of their funds went to the private sector, 6.6% was farmer initiated and 47.8% to institutions. The University of Guelph received 35.4% of the TED research funds.

We interviewed the five largest SWEEP private contractors to ascertain their satisfaction with the contracting out process. They were generally, but not unanimously, satisfied with the procedures and project and program management. Frustrations were expressed regarding delays in getting decisions and the time required to receive payment. The perceived constant changing of staff by Supply and Services Canada was mentioned as a cause of payment delays. It is generally known that a major delay occurred in the signing of a contract to manage the PWS component. This delay meant the loss of a year in starting the watershed research activities. Our terms of reference do not require and we did not investigate the problems involved in getting this component operational. The results were unfortunate from several perspectives.

One of the criticisms made in the 1987-88 Evaluation Committee report was that the research completed by some private contractors was not of the quality anticipated. The contracting procedures allowed the scientific authority to control the quality of research. Complaints were heard of delays in the completion of reports by University staff.

One of the major problems experienced by the evaluation consultant in the completion of this report was the failure of contractors and government staff to meet their deadlines. Our terms of reference did not include an evaluation of the quality of research, but during the collection of data and completion of this report, we became aware of a number of limitations which are noted.

The Farm Level Economic Analysis component suffered because of the lack of adequate planning and coordination. The persons responsible for collecting biological and water related data had differing expectations than the persons doing the economic analysis. They failed to agree and communicate about what data were required, who would collect it and how it would be recorded in the field. We believe the concept of limiting the number of individuals collecting data from the PWS farmers was well intentioned, but the assumption that farmers can and will keep adequate agronomic and economic records without constant checking was naive. There was a need for greater central control, more communication and agreement among contractors and a stronger commitment to inter-disciplinary research.

The Socio-economic Evaluation component was misnamed and we believe misconceived in terms of who was allowed to submit proposals. This component attempted to investigate the adoption process. It was not an evaluation exercise. Initially, the only people who were allowed to submit proposals were graduate students. All but one of the five university based grants were made to the University of Guelph. Subsequently, a contract was awarded to a private company to conduct an extensive literature review. We believe it would have been more appropriate to allow all qualified parties to submit proposals from the beginning of the program.

Discussion

The contracting out procedures employed by Supply and Services Canada are quite regimented and depend upon the knowledge and attitude of the staff members involved. We observed, based upon submission of proposals, that the requirements for documentation of how five year projects would be conducted were very demanding. In a number of cases, the same consultant who had produced project outlines were allowed to bid on their implementation.

A number of consultants mentioned delays in payment and the lack of a system to either quickly reconcile differences or to allow payment of most of an invoice when there were questions regarding relatively small sums of money. Another consultant was concerned by the lack of accountability of scientific authorities. If one does not agree with their interpretation or their commitments are not honored, who does one appeal to? The scientific authorities' superiors may have no or very limited responsibility for or interest in the project. The contracting process makes the consultant totally accountable, but the system is not balanced in that the scientific authorities are much less accountable for their actions..

A committee management system does not work well when activities are contracted out. Consultants end up reporting to persons who have other priorities and who report to a committee made up of individuals with limited interest in the projects. The result is that decisions do not get made within a reasonable time. The costs of delays are much more direct and real in the private sector than among University researchers or government administrators.

One question raised by a contractor was ownership of the research data and who would be responsible for maintaining the confidentiality of data. While the Crown may

claim ownership, what does this mean in terms of personal use by government or private researchers? What ethical and legal constraints exist on the transfer of data to third parties? What are the legal implications to a contractor if government employees identify respondents or give the data to others who do so? If data are collected on a confidential basis, who has access to the names of the respondents? These questions have very serious professional and financial implications for researchers.

Issue 12. Cost Effectiveness

Statement of the Issue: Are there more cost effective programs that would have achieved the same objectives?

12A. Allocation of Funds

Evaluation Question: Was there an appropriate allocation of funds between the research and development components of the program?

The staff, when asked about the appropriateness of the allocation of funds, provided few comments. Two suggested no change in the allocation and each of the following were suggested by one person: guaranteeing that more money reached the end users, farmers; less funds for incentive programs but more for demonstrations; and the flexibility to reallocate funds to the parts of a program with the greatest uptake.

It is beyond the scope of this evaluation to determine the cost and benefits of the various components. The only activity which appears to have lacked adequate financial or staff support was the OMAF Cropping, Tillage and Land Management Practices study. The initial survey in 1986 was undertaken using funds from a program for

persons on unemployment insurance. These persons had limited or no previous experience interviewing farmers. Apparently, adequate resources were not available to analyze the data and prepare a report for the 1991 survey within the initial time frame.

As shown in Table 2, the highest proportion, 26.8%, of the $30 million was spent on Soil Conservation non-economic incentives followed by 20.2% on TED research, 18.6% on PWS and 17.1% on Technical Assistance.

From these data, it appears approximately 40% was spent on research, 27% on direct payments to farmers, 30% on extension and communication and 3% on administration.

12B. Program Changes

Evaluation Question: What changes to program structure would have resulted in an improved SWEEP program?

The key respondents, when asked about the primary objectives, suggested they should: not be changed, 5; attempt to maintain productivity while minimizing the environmental impact, 6; stress cost effectiveness, 5; and focus on increasing the adoption of specific conservation farming practices by farmers, 23. Among the practices in need of further research most frequently cited were: water quality; manure management; tillage practices; milkhouse wastes; fertilizer and/or pesticide reduction; improved cropping techniques under increased residue systems; and find solutions for fine-textured soils.

The number of key respondents suggesting each type of program components to be included in a new program were: increased incentive grants, 10; improved research and technology transfer, 9; more experienced extension advisors and staff, 6; and focus

on specific needs, 12. The needs expressed range from tree planting to milkhouse wastes, to zero till on clay soils to making equipment available.

The staff proposed strengthening existing components such as OSCIA and existing extension services and practices a farmer can innovate. The farmers suggested: grants; more publicity; less talk and more action; the greater use of on farm resources; and keep on giving money. Suggestions for improved organization and program delivery made by the staff included: a more streamlined organization; less private sector involvement; targeting research at specific areas; better coordination of research and development with technology transfer; increased media and communication coverage; more full time staff; and utilizing a base year to get organized.

The key respondents suggested that a new program should be changed in terms of: delivering more programs by means of the Ontario Soil and Crop Improvement Association or jointly by OMAF and the OSCIA; more Soil and Crop Advisors; encouraging more cooperation among various groups and agencies; less bureaucracy; improved resource people; and taking a land stewardship approach.

The staff, when asked which components were most successful, identified them as follows: Tillage 2000, 40%; TED, 20%; and one person, 10% each mentioned TAP, Technical Assistance, OSCEPAP II and the communication activities.

When asked which components and activities of SWEEP were most successful, the key respondents most frequently cited one of the specific program components. Thirteen said the local demonstrations, Tillage 2000 and tours were most successful. Five cited the advisory and extension services. TED and TAP were mentioned by three and two farmers respectively. Four mentioned the high level of farmer involvement, three the dedication of staff and three the development of new equipment.

The five consultants interviewed believed that the most successful aspect of SWEEP was the strong demonstration aspects of the program. They claimed that the research activities were shown to have practical applications. There was a high level of participation in the PWS and there now are planning tools which can be used in other areas.

The program components considered least useful by the staff were: Farm Level Economic Analysis, 3; and one person cited each of the following - TAP, CIB, the Socio-economic Research component and the water quality component. Two persons did not have an opinion.

The components and activities considered least successful by key respondents were: getting technology transferred to farmers, 5; the Farm Level Economic Analysis, 4; PWS, 4; the Communication component, 3; and the failure to indicate whether or not phosphate levels had been reduced.

The consultants were most critical of assistance programs such as OSCEPAP, the data collected for the Farm Level Economic Analysis and the inadequate time period under which data had to be collected in the PWS. One said the grant programs are ad hoc, short term and the farmers revert to their old ways after they take the grant money.

Discussion

The program appears to have been relatively cost effective given that it was quite innovative in both its focus and organization. The attempts to measure phosphorus and agronomic factors which influence it at the watershed level was expensive and not completely successful for reasons which are discussed in earlier sections of this report. One cannot predict with a high degree of accuracy the outcomes of field experiments, especially when the results are controlled by precipitation rates.

The program attacked the issue of soil and water conservation from many perspectives simultaneously. A more deliberate, sequential expenditure of funds might have produced greater research results, but time is of the essence in solving environmental problems. The lack of apparent follow-up is of concern given that measuring equipment is already in place at the pilot demonstration watersheds and several years data are available. The development of private sector research and extension expertise was mentioned also. Much of the latter will be lost if funding does not continue.

Issue 13. Conservation Information Bureau

Statement of the Issue: How effective was the Soil and Water Conservation Information Bureau?

Issue 13A. Organizational Framework

Evaluation Question: Was the organizational framework appropriate?

The Soil and Water Conservation Information Centre (CIB) was originally conceptualized as a federally funded agency to collect, catalogue, process, store and distribute technical data. Initially, the SWEEP Agreement provided funding not to exceed $1 million over five years. The Centre's full costs were to be covered during the two year start-up period with support being reduced over years 3, 4 and 5. The objective was for the Centre to be totally self-supporting by year 6.

The design of the CIB was based upon a study completed in 1986 by the senior evaluation consultant (79) and three reports prepared by Ecologistics Limited (43) in 1987. The latter reports included draft terms of reference, letters patent, a draft

constitution, by-laws and an organizational plan including computer requirements, staffing and a draft budget. As of mid 1987, the CIB was to operate as a private, non-profit corporation with its headquarters in Guelph. The Federal Government was to have 2 of the 15 members of the Board of Directors.

In the spring of 1988, a proposal was made by the Director (Ontario) Agricultural Development of Agriculture Canada for the establishment of a Soil and Water Information Bureau as part of the Centre for Soil and Water Conservation at the University of Guelph. There was no documentation of why the change in structure and organization of the CIB. We believe it was due to three factors, namely: a change in Agriculture Canada personnel; a desire by Agriculture Canada to provide funding to the University of Guelph and opposition to a federally funded centre based upon standing traditions as to the roles of OMAF and Agriculture Canada in agricultural extension activities.

The Memorandum to the Minister re the establishment of CIB at the University of Guelph stated that the CIB would be: funded by means of a grant of up to $1 million over five years commencing in 1988-89; provided with full funding during the first four years of operation with support being reduced in year 5; and the Bureau was to be self-supporting in year 6. "The operation of the Information Bureau was to be guided by an Advisory Committee which will meet quarterly to establish priorities, review progress and ensure co-ordination of effort. The Advisory Committee will include the manager, two members from Agriculture Canada, one from OMAF, two from the private sector and one from the University of Guelph. Agriculture Canada will chair the Advisory Committee" (2).

The Contribution Agreement, signed March 3, 1989 with the University of Guelph (1), amended the composition of the Advisory Committee to be consistent with a Memorandum to the Minister (2) signed by the Regional Director (Ontario). This change was significant in that it increased the membership to two persons from OMAF, two from Agriculture Canada, two farmers, one agri-business, two University of Guelph, one of whom would chair the Committee. The Bureau manager and Director of the Centre for Soil and Water Conservation are to serve as ex-officio members. The Contribution Agreement provided for payment to the University of overhead costs based on 65% of salaries and 2% of travel.

The CIB, put in place in 1989, differed from earlier conceptualizations in that: it was managed by the University and the terms of reference had been widened to include innovative farmers as a primary user and included activities such as the preparation of educational materials. The concept of the CIB becoming self-sustaining, still existed and was pursued by the Advisory Committee until they learned of the possibility of Green Plan funding. At that point, the Advisory Committee directed the staff to explore Green Plan funding.

The structure of the CIB was deficient, in our opinion, in that the chair of the Advisory Committee was simultaneously the representative of the contractor, the University of Guelph. This conflict would not have arisen if one of the Agriculture Canada representatives had been Chair of the Committee as was proposed in an earlier organizational proposal.

We do not wish to imply this conflict had any negative effects on the CIB because none were observed. We do not believe individuals should be put in situations where conflicts such as this occur. Agriculture Canada relinquished control of the CIB to a greater degree than was appropriate given they were the sole financial contributor.
A further structural problem with the CIB was the lack of strong control by the Advisory Committee. The staff were criticized by the Evaluation Committee in 1991 for inadequate work plans and failing to complete projects (50).

We believe much of the responsibility for inadequate planning and reporting lies with the Advisory Committee. The contract with the University explicitly states "The University agrees to submit annual reports to the Minister. These reports will include statements on goal achievement and performance and detailed financial statements" (1). We were not able to acquire any reports by the University and we were told by the Chair of the Advisory Committee that the only reports available were those provided by the Bureau Director in 1990 and 1991. No report was available for 1992 or 1993. An activity report was prepared by CIB staff at the consultant's request. Both the University and Agriculture Canada appear to have been very relaxed about reporting responsibilities. No CIB files were found in the Agriculture Canada library for the last two years.

Differences of opinion on the annual allocation of monies developed between the CIB and Agriculture Canada. Funding of about $260,000 beyond the initial $1 million was provided by Agriculture Canada for contractual activities. Some of this money was for new activities while part was not. It is uncertain whether or not all of these funds would have been required to maintain the CIB if more rigorous financial planning had occurred. The additional projects were funded as contribution agreements or sole sourced through Supply and Services Canada.

13B. Activities

Evaluation Question: Did they catalogue, reproduce and distribute information as defined in their contract?

The CIB staff catalogued, reproduced and distributed information as required in their terms of reference. They have established data bases, literature surveys and provided an on-line service to users. Their major communication activity has been the development of their newsletter "InfoSource" which is mailed to approximately 10,000 members of the Ontario Soil and Crop Improvement Association and others in the industry. Thirty percent of the farmers surveyed by the evaluation consultant were aware of this component of SWEEP and 11.5% said they had used the InfoSource newsletter.

Our concerns re staff activities are the apparent lack of work plans, the time spent on seeking Green Plan funding and some of their activities involving the general public rather than the agricultural industry. The emphasis on public education, while tenable, is not an explicit part of their specified contractual activities. The CIB, if given more specific focus and increased interest and direction by the Advisory Committee, have the resources and capability to become the premier conservative information agency.

13C. Usefulness of Service

Evaluation Question: How useful was their service?

Eight of the ten staff interviewees said the CIB was useful, but only four said it should be included in future programs. Among key respondents, just over half, 13 out of 25, said it was useful, four said it was not and 8 did not answer. Over two-thirds said it

should be included in future programs and the remainder did not reply.

Two-thirds of the staff said the CIB was moderately successful and all but one of the others said it was slightly successful. One person said it was not successful because it did not become self-sufficient. The level of implementation and inability to provide pertinent literature to innovative farmers were cited by those not impressed with its achievements. Another criticism was that the mandate was not well defined and its activities got tied up in University bureaucracy. Two staff made relatively positive comments that it did what it was asked to do and another said it represented a professional approach to communication.

Fifteen percent of the farmers, when asked who they would most like to get information on Soil and Water Conservation programs and practices from, checked the CIB. Out of 11 potential sources, CIB ranked seventh from the top. This may indicate a lack of awareness, meaning the CB should have done more to promote itself.

13D. Financial Support

Evaluation Question: Was the level of financial support appropriate?

Whether or not the level of support provided to the CIB was adequate to carry out their terms of reference is difficult to determine. The CIB received funding in addition to their $1 million budget totalling approximately $350,000. These were to: conduct specific activities such as organizing and preparing a report of the stakeholders; Green Plan Forum at Kempenfelt Bay; a literature search on buffer strips; a directory of persons interested in environmental sustainability; the no-till conference in Hamilton; a brochure on the Great Lakes Water Quality Agreement; etc.

All of these activities are so similar or complementary to their ongoing work activities that it is difficult to estimate the degree of incrementality involved. Without these extra projects, which were provided on a sole source basis, the CIB would not have remained financially viable until March 31, 1993. Some of the funding appears to represent a desire to maintain the CIB's existence until a decision was made on Green Plan funding which will now ensure it continues.

Initially, the CIB was explicitly expected to seek non-government funds so it would become self-sufficient in Year 6, April 1, 1993 onward. Since only a small amount of non-government funding was secured, this goal was not achieved.

Discussion

The CIB was more controversial than the other SWEEP components. The basic design of the Bureau changed from a stand alone agency to one operated by the University of Guelph. As noted above, the organizational structure did not lend itself to tight management controls. The Advisory Committee consisted of four groups with quite different interests. The Agriculture Canada representatives' interests were to expand into the information and extension area. The OMAF interests were attempting to protect their former monopoly on agricultural extension activities. The University interests were attempting to gain influence and monies from a program which initially excluded them and finally the farmers and agribusiness representatives were attempting to get more applied research for use by farmers.

Superimposed on these institutional conflicts were several individuals with strongly held beliefs about the appropriate way to proceed. The CIB was subsequently established within an institutional environment which emphasizes freedom of action more than accountability. Despite the organizational environment, the staff made significant achievements.

In retrospect, the planning and reporting functions were weak. We believe more independent control and improved communication between staff and the Advisory Committee and the contractor, Agriculture Canada and the contractee, the University would have led to greater achievement at less cost. Tighter financial controls would have made extra funding by Agriculture Canada unnecessary. A location outside of the University campus, with improved parking access, would, we believe, have encouraged greater use of services by farmers and extension personnel.

MAJOR FINDINGS AND CONCLUSIONS

Phosphate Load Reduction

We conclude that, while the level of phosphorus loadings decreased, it is not possible to document the extent of the decrease. Substantial research problems were experienced in measuring phosphorus at the watershed level due to wide variations in precipitation. The modelling activities were limited to alternative sources of data. The result is that definitive conclusions cannot be drawn at this time. While changes in loading levels were not achieved to the extent desired, considerable research was conducted on phosphorus loading and modelling work is still proceeding.

Productivity Objective

The research has demonstrated that conservation practices have reduced erosion and generally increased the level of productivity. The primary advantage of conservation tillage has been demonstrated to be decreased costs. No-till and minimum till have obvious advantages in terms of operating costs because they require less labour, fuel and expensive equipment. The FLEA research demonstrated that no-till systems are no riskier than conventional tillage practices.

The economic impact of conservation tillage was not estimated for the SWEEP area. Neither the costs nor the estimates of the adoption of conservation practices could be made because a key study was not completed on time. The program produced a very substantial and useful body of applied knowledge. This body of knowledge has not yet been widely disseminated to or adopted by farmers. There has been a substantial increase in awareness of conservation farming practices since 1986, but many farmers are still unaware of SWEEP and of many useful conservation practices.

Attitudes toward soil and water conservation appear to have become more positive in the past six years. This has occurred primarily because of: an increased awareness of the extent of the problem; increased awareness of both problems and solutions resulting from media coverage; acceptance that conservation tillage is more efficient even if yields do not increase; and attitudes have changed as the result of good experiences on their or their neighbours' farms.

The SWEEP program has both significantly increased private sector capability and demonstrated that much work formerly done exclusively by public institutions can be done effectively by private contractors. Several problems in contracting out were identified. There are still unresolved issues relating to inproving the managerial capability of scientific authorities, resolving contract differences, expediting payments and guaranteeing data confidentiality.

The major weakness of the program identified was the use of committees rather than individuals in the management process. The committee framework reduced communication and slowed the decision making process. We believe there was a need for an organizational structure which clearly identified someone who was responsible for and provided them with adequate authority to make decisions quickly.

The CIB suffered from inadequate direction and weak control by the Advisory Committee. Agriculture Canada financed the CIB, but relinquished control of the Advisory Committee and did not tightly monitor the University of Guelph.

While the information created is of substantial value, we believe that one of the major long term benefits of SWEEP will be the development of working relationships among five government departments, conservation authorities, the University of Guelph, private consultants, farmers and farm organizations. The willingness of many

individuals to work together has helphed breakdown barriers and clearly demonstrated that joint programs can be both comprehensive and effective. We recognize that conflicts existed and will continue to arise in the future, but they were relatively unimportant. Hopefully, SWEEP has demonstrated a useful model of how many interrelated sectors of the agricultural community can work together. The current and probable future limitations on financing can be better addressed if all the parties agree to work together.

We conclude that the SWEEP program did not achieve its goal of reducing phosphorus loadings by 200 tonnes per year. It generally achieved its objective of improving the productivity of Southwestern Ontario agriculture by reducing or arresting erosion and other forms of soil degradation.

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APPENDIX 1

PERSONS INTERVIEWED

List of Persons Interviewed

The following persons graciously assisted in this study. They are listed alphabetically.

Name	Institution	Location
Abma, Kevin	Beak Consultants	Guelph
Bohl, Martin	OMAF	Guelph
Brown, Bill & Clare	Farm Community	Woodstock
Charlton, Dave	Ecological Services for Planning	Guelph
Chevalier, Charles	Farm Community	
Cressman, David	Ecologistics Limited	Kitchener
Driver, Galen	OMAF	Guelph
Eddie, Jim	Ontario Ministry of Energy	Toronto
Findlay, Wally	Agriculture Canada	Harrow
Graham, Andrew	OSCIA	Guelph
Hack, Richard	Deloitte & Touche	Guelph
Hayes, Adam	OMAF	Ridgetown
Hicknell, Mike	Agriculture Canada	Guelph
Jocius, Ginty	Ginty Jocius & Associates	Guelph
Johnston, Russ	R.C.A.T.	Ridgetown
Kachanoski, Gary	University of Guelph	Guelph
Kalinauskas, Rimas	Environment Canada	
Kamp, Len	Environment Canada	Guelph
Kennedy, Brent	OMAF	Guelph
King, John & Tom	Farm Community	Hickson
Little, John	Farm Community	
Lobb, Don	Farm Community	Clinton
Lynch, Pat	Cargill Fertilizer	Shakespeare
Miller, Murray	University of Guelph	Guelph
Milligan, Larry	University of Guelph	Guelph
Myslik, Jim	OMAF	Fergus
Norry, Herb	Herb Norry & Associates	London
Prong, Ron	Till-Tech Systems Limited	St. Thomas
Rimmelzwaan, Jim	Farm Community	London
Robinson, Doug	Conservation Information Bureau	Guelph
Sadler-Richards, Jane	CMS/Ecologistics Limited	Lucan
Sawyer, Tom	Fertilizer Institute of Ont. Inc.	Cambridge
Schantz, Roger	Beak Consultants	Woodslee
Schleihauf, John	OMAF	Guelph
Scott, Alan	OMAF	Stratford

Name	Institution	Location
Shantz, Christine	Farm Community	Pittock
Spencer, Vern	OMAF	Guelph
Swanton, Clarence	University of Guelph	Guelph
Tomecek, Ed	OMAF	Ridgetown
Vriesacker, Robert & Alan	Farm Community	Woodslee
Walker, Robert	Beak Consultants	Guelph
Wall, Greg	Agriculture Canada	Guelph
Wright, Harvey	OMAF	Guelph

APPENDIX 2

FARMERS SURVEY

INTRODUCTION

Background

Farmers' perceptions of and participation in SWEEP were central themes of the Evaluation Assessment prepared in 1986 by The DPA Group Inc. and in the research design prepared for this evaluation. A survey of farmers in the SWEEP study area was deemed essential. A mail survey was conducted for Agriculture Canada in 1987. The survey was supposed to provide baseline data for the evaluation to be conducted at the completion of the project. Unfortunately, the survey conducted in 1987 was under-financed and the response rate was only 20%. The design was, in our opinion, open to question as a result of sampling the same number of farmers in each county and establishing a criteria that 20% of the farmers sampled were to have an income of $10,000 or less.

The 1986 survey questionnaires were mailed by Statistics Canada to a sample of 1196 farmers in the 12 counties. No follow-up procedures were utilized. Since the mailing list was confidential to Statistics Canada, there was no way we could identify or contact the previous respondents. We preferred to start with an up-to-date sampling list, rather than mail to the entire 1986 list which, by 1992, was likely out of date. We also wanted a sample which was more representative by county. Thus, a new survey of farmers was decided upon.

RESEARCH METHODS

Data Collection

Given the evaluation budget, it was decided that a mail survey with follow-up telephone calls to assure a 50% response rate would be conducted. Initially, we proposed that Statistics Canada select the sample and provide the evaluation consultant with mailing labels and a list of potential respondents. We would have conducted the follow-up phone calls.

Statistics Canada, despite enabling legislation, was unwilling to provide the evaluation consultant with the sampling list. It was then agreed that the Statistics Canada regional office in Toronto would conduct enough telephone follow-up interviews to provide a minimum response rate of 50%.

Sampling Criteria

A sample size of 800 was established with a minimum response rate of 50%. The sampling area was the 12 counties in which SWEEP operated. The sample included all farm operators who reported to the 1991 Census of Agriculture, a minimum of 50 acres in annual crops and a farm income of at least $10,000.

Questionnaires

The questionnaires were designed and pretested by the evaluation consultant. Approximately 10 knowledgeable individuals and farmers were asked to comment on the questionnaire. A total of 799 questionnaires were mailed by Statistics Canada on October 16, 1992. About two weeks later, a follow-up letter was also mailed thanking the farmers for their assistance and asking those who had not replied to do so.

The Statistics Canada staff in Toronto, who conducted the telephone calls, were briefed on the questionnaire. They called non-respondents utilizing a list provided to them on a confidential basis by Statistics Canada in Ottawa. The questionnaires had been identified by numbers so non-respondents could be identified by Statistics Canada. The staff were instructed to concentrate on farmers in those counties where fewer than 50% had already responded by mail.

The evaluation consultant informed Statistics Canada of which numbers had been returned so they were able to identify and select only the non-respondents. Very few farmers were contacted who had already returned their questionnaires.

Survey Results

A total of 327 useable questionnaires were returned by mail and 100 telephone interviews were conducted by Statistics Canada. The total exceeded the sampling target of 400 because the number of questionnaires received by mail after the initial cut-off date was higher than anticipated.

Of the 799 questionnaires mailed, 20 were returned as undeliverable, 8 of those returned by the farmers were incomplete or the identification number had been removed and 327 were useable. The useable mail survey response rate was 42.0%. The total survey response rate including telephone interviews, based upon 427 replies from 779 farmers, was 54.8%.

Data Analysis

The mail questionnaires and those completed by telephone were coded and analyzed using a standard statistical computer program. The mail and telephone responses were compared to determine whether or not they differed significantly. Generally, the two

data sets were similar, with a few exceptions. The farmers who returned their questionnaires, as might be anticipated, were more aware of and interested in SWEEP and conservation issues than the telephone respondents. For example, 6.5% of the mail but none of the telephone respondents were able to identify SWEEP correctly, even though 40.1% and 42.0% respectively of the two samples said they had heard of SWEEP.

While 88% of the mail, but only 69% of the telephone respondents said they consider soil and water issues when developing cropping and tillage plans for the year, the farmers in both groups, who did consider these issues, considered the same factors. A major difference between the two samples was in the percentage of "no reply" responses. Telephone respondents were more likely to reply to a question because the interviewer's presence encouraged some response. The differences raise the question as to the extent to which the survey results can be generalized to the total farmer population. This is always a problem, especially when the respondents are self-selected, as occurs with all mail surveys.

The farm characteristics of those who returned a questionnaire and those telephoned were reviewed. The mail respondents were more likely to: rent land than telephone respondents, 50% vs 30%; grow corn, 67% vs 53%; winter wheat, 57%vs 44%; spring grains, 46% vs 26%; but less likely to grow tobacco, 4% vs 9%. The single most important income producing enterprise, the total acreage operated, gross sales and the acreage of crops grown were not significantly different except that the telephone respondents grew larger acreages of corn silage and winter wheat. The farmers did not differ significantly in age, but the mail respondents had achieved significantly higher levels of education.

FINDINGS

Introduction

The responses of the 427 farmers are summarized below. The number of persons selecting each response category and the average for the numeric categories may be found in Appendix 1. Unless indicated, the percentages are based on 427. The results are presented in the same sequence as the questions were asked in the questionnaire. Selected questions were crosstabulated by county, level of gross sales, age, education and awareness of SWEEP.

Farm Characteristics

The distribution of farmer respondents by county was as shown in Table 1.

Table 1. Distribution of Sample and Respondents by County

	Sample		Respondents	
County	#	%	#	%
Huron	113	14.2	64	15.0
Perth	104	13.1	54	12.6
Lambton	86	10.8	44	10.3
Kent	76	9.5	39	9.1
Oxford	72	9.0	39	9.1
Haldimand-Norfolk	67	8.3	37	8.7
Middlesex	77	9.6	37	8.7
Wellington	60	7.5	35	8.2
Elgin	52	6.5	31	7.3
Essex	33	4.1	20	4.7
Waterloo	36	4.5	16	3.7
Brant	23	2.9	11	2.6
Total	799	100.0	427	100.0

The average farm was 296 acres in area. The area in crops averaged 257 acres, of which on average, 182 acres were owned. The 49% who rented land, grew crops on an average of 85 acres. The average acreage in each crop and the number of farmers reporting each crop is shown in Appendix 1. More farmers, 64%, reported grain corn than any other crop. An average of 272 acres were reported by those growing grain corn. Soybeans and winter wheat were reported by 54% of the farms, but the average areas of soybeans, 116 acres, was substantially greater than the 60 acres reported by wheat growers.

Almost two-thirds, 63.5%, of the farmers reported having livestock or poultry. The most important income producing enterprise among respondents was cash crops 41.8%, dairy 23%, and 13.4% for beef. Four out of five of the farms, 80%, had a stream or ditch on or next to their land. The percentages ranged from a high of 92% in Kent to a low of 64% in Brant.

Farmer Perceptions

Perceptions of Conservation Issues

When asked how important it is for farmers to reduce soil erosion and runoff for four reasons, the average scores based upon a five point scale ranging from Not Important to Very Important were as follows: impact on cost of drainage ditch maintenance, 4.1; impact on productivity of their own farms, 4.3; impact on neighbouring farms, 4.0; and impact on the environment in general, 4.3. The farmers are more concerned about the impact on their own farms, the environment in general and neighbours in that order. Concern for all four issues generally increases with education and gross farm sales. It is higher among farmers in the 55-64 years group and generally lowest among those older than 64 years. See Table 2.

Table 2. Importance of Soil Erosion by Education, Age and Gross Sales

Impact	Education				Age					Gross Sales				Total Sample
	Average Importance Score *													
	Elem-entary	Some HS	HS + Coll	Ag Coll/ Univ	<34	35-44	45-54	55-64	65+	<50K	51-100	101-250	251+	
1. Drainage Costs	4.3	4.0	4.1	4.0	3.9	4.1	4.1	4.2	4.2	4.2	4.0	4.0	4.4	4.1
2. Own Productivity	4.4	4.1	4.3	4.5	4.3	4.5	4.3	4.4	4.1	4.3	4.4	4.2	4.5	4.3
3. Neighbor's Farm	4.2	4.0	4.0	4.0	3.8	4.0	3.9	4.2	4.1	4.0	4.0	4.0	4.2	4.0
4. Environment	4.4	4.2	4.2	4.3	4.3	4.3	4.2	4.3	4.2	4.3	4.2	4.2	4.4	4.3

* 1 = Not Important, 5 = Very Important

Five out of six, 83.3%, of the farmers consider soil conservation and water quality issues when they develop their cropping and tillage plans for a new crop year. The farmers were asked to check up to five conservation related issues. The percentage of farmers considering each of the issues was as follows:

Weed control	60.8%
Crop yields	60.2
The costs involved	57.1
Potential erosion	48.7
Soil compaction	45.0
Manure application	40.6
The probable returns	38.3
Timeliness field operations	32.6
Machinery or equipment	26.2
Management	19.3
Labour	15.3

The farmers were asked a series of related questions to ascertain their awareness of the SWEEP program. They were first asked if they had heard of the SWEEP program. Forty percent said they had, but only 5.5% were able to correctly write out what the letters SWEEP stood for. Four percent gave an incorrect answer and 31% were unsure. Awareness was related to level of education and level of gross sales, but not quite significantly related for age. See Table 3.

Table 3. Awareness of SWEEP by Education & Gross Sales

Education	Aware		Identify Name			
	Yes	No	Correct	Incorrect	Unsure	Unaware
Elementary	32.2	67.8	0	1.1	32.2	66.7
Some High School	29.1	70.9	1.0	4.0	27.3	67.7
High + Some College	41.0	59.0	5.0	6.6	29.8	58.7
Completed Post Secondary	57.8	42.2	13.8	3.7	34.9	47.7
Total	40.6	59.4	5.3	4.1	31.0	59.7
Gross Sales						
Less 51K	29.2	70.8	3.4	2.5	21.8	72.3
51 - 100	43.0	57.0	6.5	5.4	35.9	52.2
101 - 250	40.1	59.9	4.3	5.0	30.2	60.4
251+	58.6	41.4	10.3	3.4	43.1	43.1

* Totals do not add to 100% because separate questions re awareness and identification of program.

Awareness of SWEEP was lowest among farmers with some high school at 29.1% and highest for those who had college or university training, 57.8%. The level of awareness and knowledge are substantially higher for those who have gross sales in excess of $250,000. Just over one-half, 58.6% were aware and 10.3% knew what SWEEP meant, compared to 35.2% and 1.9% respectively of those who sold $100,000 or less.

SWEEP Awareness

Of the 172 farmers who have heard of SWEEP, 161 indicated their sources of information. The sources in order of importance were:

	Number	%
Farm Press/TV	58	36.0
Soil Advisors	45	27.9
Publications	41	25.5
OSCIA Land Stewardship Committee	36	22.4
Other Farmers	32	19.9
OMAF Staff	28	17.4
SWCIB	26	16.2
Conservation Authority	18	11.2
Others	8	5.0

The most important source identified by the 43 farmers who replied were:

	Number	%
Soils Advisor	10	23.2
Farm Press/TV	7	16.2
Publications	6	14.0
OSCIA Committee	6	14.0
OMAF Staff	4	9.3
Soil & Water Conserv. Info Bureau	4	9.3
Other Farmers	3	7.0
Conservation Authority	3	7.0
Total	43	100.0

A total of 38 suggestions for improving the SWEEP program were made by 33 farmers as follows:

	No. of Suggestions	% of Farmers
Increase $ to farmers	9	27.2
Program a waste of time	5	15.1
Publicize more	4	12.1
Less talk and more action	4	12.1
Simplify or less complicated	3	9.1
Use more on farm resources	2	6.1
Keep giving money	2	6.1
Satisfied as it is	2	6.1
Other	7	21.1
Total	38	100.0

Program Participation

Awareness and Participation in Program

The best known SWEEP programs were: farm tours, 52.0%; conservation information meetings, 44.3%; Tillage 2000, 32.5%; conservation practices surveys, 29.7%; OSCEPAP II, 28.8%; PWS, 26.5%; Side-by-Side, 23.2%; TED, 5.7%; and TAP, 4.0%.

Participation levels are also shown in Appendix 1. The programs in which individuals participated most were: farm tours, 21.8%; conservation information meetings, 18.5%; Info Source Newsletter, 11.5%; and OSCEPAP II, 11.0%. When asked which program they were most involved with, they answered as follows: OSCEPAP II, 42%; TAP, 3.8%; and Conservation Information Meetings, 3.7%.

Why Not Participate

The major reason given by farmers for not participating in SWEEP were: not aware, 36.3%; not useful to their farm, 22.2%; and not enough information, 17.3%. These percentages are based upon the total sample.

Seventy percent of the farmers said they are aware that soil conservation advisors or soil and crop advisors were available to assist farmers with various conservation practices. Almost one-third, 31.1%, had obtained information or assistance from an advisor. The farmers who completed high school and those who attended post-secondary institutions were more likely to have obtained advice, 38.7%, compared to 24.2% of those who had not completed high school. Over half, 54.4%, of the farmers with gross sales of over $250,000 obtained advice compared to only 22.7% of those with sales of less than $50,000.

The type of assistance obtained by those doing so was as follows: listened to at a meeting, 62.1%; printed information, 56.8%; on farm visits, 40.9%; and on farm help with a conservation practice, 21.2%. When the latter two are combined, we note that three-fifths of the 132 farmers who received assistance did so while the advisor was on their farm.

Practices Being Used

The soil and water related conservation practices being used by farmers are shown in Table 4. Also shown are the percentage of farmers who began using the practices since 1986 when SWEEP began and the percentage who say they began because of SWEEP. Fewer than half of the farmers who said they are using a practice had begun doing so since 1986 when SWEEP began. This was true for all practices investigated. The only two practices, which over 2.0% of all farmers began because of SWEEP, were maintaining over 20% residue cover and pesticide storage or handling facilities.

The responses suggest that, on average, about one-third of the farmers now use the practices, one-eighth have began doing so since 1986, but only 1% have done so as the result of SWEEP.

Table 4. Practices Presently Used, Began Using Since 1986 and Began Because of SWEEP

	Use Now	Began Since 1986	Began Because of SWEEP	Estimated SWEEP Influence
	a	b	c	(c/b x 100)
	%	%	%	%
Forages in crop rotation	67.2	21.3	0.9	4.2
Tile drainage improvements	52.5	17.3	0.9	5.2
Plowdown crops	51.5	18.0	0.9	5.0
Reduced fertilizer use	47.3	19.0	0.9	4.7
Reduced pesticide use	44.3	17.8	0.9	5.1
Maintaining over 20% residue cover	42.2	19.2	2.1	10.9
Winter cover crops	36.8	14.8	1.4	9.5
Pesticide storage/handling facilities	33.7	16.6	2.1	12.7
Tree windbreaks and block plantings	30.9	14.3	1.4	9.8
Conservation tillage/planting	30.0	16.2	1.2	7.4
Manure storage/handling improvements	25.8	11.5	1.2	10.4
Grassed waterways	25.8	8.9	0.2	2.2
Ditch and streambank protection	23.7	10.1	0.9	8.9
Erosion control structures	19.7	9.1	1.4	15.4
Fencing livestock from water courses	14.8	6.3	0.2	3.2
Milkhouse waste disposal	11.7	4.9	0.7	14.3
Fencing of woodlots	10.3	3.7	0.2	5.4
Contour farming/stripcropping	7.3	2.3	0.2	3.9

Almost half, 47.8%, of the respondents said they had considered, but not yet adopted at least one of the conservation farming practices listed in Table 4. The practices considered most seriously but not adopted are listed in Table 5.

The percentage of farmers adopting since 1986 due to SWEEP is shown in the last column of Table 4. This number was derived by calculating column 3 as a percentage of column 2. The practices most influenced by SWEEP were: erosion control structures; milkhouse waste disposal; and pesticide storage/handling facilities.

Table 5. Practices Considered But Not Adopted

Practice Not Adopted	Farmers	
	Number	Percent
Conservation tillage/planting	30	17.1
Manure storage/handling improvements	30	17.1
Tree windbreaks and block plantings	18	10.3
Tile drainage improvements	17	9.7
Maintaining over 20% residue cover	9	5.1
Reduced pesticide use	8	4.6
Grassed waterways	8	4.6
Pesticide storage/handling facilities	8	4.6
Milkhouse waste disposal	8	4.6
Contour farming/stripcropping	7	4.0
Winter cover crops	6	3.4
Erosion control structures	6	3.4
Plowdown crops	5	2.9
Fencing livestock from water courses	5	2.9
Reduced fertilizer use	4	2.3
Ditch and streambank protection	4	2.3
Forages in crop rotation	1	0.6
Fencing of woodlots	1	0.6
Total	175	100.0

The reasons given for not adopting are as follows:

Lack of money	61.0%
Not convinced will work	24.8
Lack of time	20.0
Lack of information about the practice	16.2
Other	13.3
Still testing	11.4
Concerned it may be too risky	11.0
Not sure can operate or manage it properly	8.6
Tried, but not successful	3.3
Not available or depends upon others	1.4

The reasons for "not adopting yet" may be usefully reordered in a manner consistent with adoption-rejection theory to illustrate at what stage in the process the farmers presently are. The number not yet adopting within the three stages of knowledge, attitude and decision-making criteria are as shown:

Stage		
Information	Persuasion	Decision Making
		Reasons for not deciding to adopt
16.2% lacked adequate information	24.8% were not convinced the practice will work.	61.0% lacked financial resources. 11.0% are concerned that the risk was too high. 20% lacked the time to make the change 8.6% not sure capable of implementing the practice. 3.3% have tried but found the results unsatisfactory.

Conservation Information

Information Needs

Over three-fifths, 62%, of the farmers believe they have adequate information about soil and water conservation programs and practices. The responses to this question were strongly influenced by education level. Of the farmers with an elementary school education, 76.4%, say they have enough, those with some high school, 63.0%, completed high school, 57.1% and post secondary education, 53.3%. It is unclear whether those who are better educated are less well informed or desire more information. The latter conclusion appears more logical.

Almost half, 46.7%, of the respondents want more information on soil and water conservation. The desire for additional information is independent of educational level and farm sales, but is related to the age of the operator. The percentage of the five age categories saying they want more information were: 25-34 years, 57.4%; 35-41 years, 50.9%; 45-54 years, 52.4%; 55-64 years, 44.0%; and 65 and older, 20.0%. Desire for further information is inversely related to age.

The type of information desired is shown in Table 6. Note that each respondent could identify up to three types of information or subjects.

Table 6. Types of Information/Subjects

Information Type	% Mentioning
Reduced pesticide use	19.4
Reduced fertilizer use	19.2
Conservation tillage/planting	17.1
Tile drainage improvements	15.0
Tree windbreaks and block plantings	14.8
Maintaining over 20% residue cover	13.6
Manure storage handling improvements	12.2
Ditch and streambank protection	10.8
Plowdown crops	10.5
Winter cover crops	9.4
Pesticide storage handling facilities	7.7
Forages in crop rotation	7.5
Erosion control structures	6.3
Grassed waterways	5.9
Contour farming/stripcropping	4.0
Milkhouse waste disposal	4.0
Fencing livestock from watercourses	3.5
Fencing of woodlots	1.9

When asked who they would most prefer to get information from, the farmers responded as follows. Up to three sources could be indicated.

	%
Soil Conservation Advisors/Soil & Crop Advisors	45.4
Other OMAF Staff	34.6
OMAF/Ag Canada Publications	33.8
Other Farmers	22.1
OSCIA Land Stewardship Committee	21.3
Farm Press/Radio/TV	16.7
University/Ag Canada Researchers	15.8
Soil & Water Conservation Info Bureau (InfoSOURCE Newsletter)	15.4
Conservation Authority	13.8
Fertilizer/Pesticide Company Representatives	12.1
Machinery Company Representatives	3.8

Demographic Characteristics

Farm

The level of gross farm sales reported were:

Less than $10,000	3.6%
$10,000 to $50,000	25.4
$51,000 to $100,000	22.5
$101,000 to $250,000	34.4
$251,000 to $500,000	9.7
Over $500,000	4.4

Farm Operators

The average length of time farming at their present location was 23.4 years. The age distribution of the farmers responding were as follows:

Under 25	1.2%
25 to 34	11.7
35 to 44	27.4
45 to 54	26.2
55 to 64	18.7
65 and over	14.8

The highest level of education the farm operator had attained was as follows: Some

Completed agricultural diploma or degree	17.7%
Completed non-agricultural college/university	8.0%.
Some college or university	10.4%
Completed high school	18.4%
Some high school	24.3%
Elementary (1-8)	21.2%
	100.0

The relationships among age, education and gross farm sales were investigated. Age and education were inversely related, see Table 7.

Table 7. Relationship Between Age and Education

Education	Age					
	25-34	35-44	45-54	55-64	65 over	Total
Elementary	5.6	9.4	20.6	29.5	47.6	21.1
Some High School	14.8	13.7	33.0	33.3	25.4	24.3
HS/Some College	35.2	40.2	23.2	21.8	20.6	28.8
College/University	44.4	36.8	23.2	15.4	6.3	25.7
Total	100.0	100.0	100.0	100.0	100.0	100.0

The older the respondents, in general, the lower their educational attainment. Of the farmers who are 44 years or younger, 39.2% completed college or university and a further 36.8% had completed high school or had some college or university (post-secondary) experience. Seventy-three percent of the farmers who were 65 or over had not completed high school.

Education and level of gross sales are positively related, see Table 8.

Table 8. Relationship Between Education and Level of Sales

Level of Gross Sales	Education				
	Elementary	Some HS	HS/Some College	Coll./Univ.	Total
$10,000 - 50,000	29.2	38.6	29.2	20.0	29.3
51,000 - 100,000	20.2	32.7	20.0	18.0	22.7
101,000 - 250,000	38.2	24.8	32.5	41.0	33.9
251,000 - 500,000	12.4	4.0	18.3	21.0	14.1
Total	100.0	100.0	100.0	100.0	100.0

Farmers who had not completed high school tend to have sales of $100,000 or less and those who completed a post-secondary education were more likely to be among those with sales in excess of $100,000 per year.

Sales were related to the age of the farm operator with those from 35-44 years having the highest sales. As shown in Table 9, 60% of the farmers under 45 have sales of over $100,000, while only 23% of those 65 years or over have sales this large. Over half the farmers from 55-64 and two-thirds of those 65 years and over have sales of $50,000 or less.

Table 9. Relationship Between Age and Level of Sales

	Age					
Level of Gross Sales	25-34	35-44	45-54	55-64	65 over	Total
$ 10,000 - 50,000	20.8	19.8	24.8	30.0	60.0	29.1
$ 51,000 - 100,000	18.9	18.9	23.9	31.3	16.7	22.5
$101,000 - 250,000	47.2	36.9	38.5	25.0	23.3	34.4
$251,000 - 500,300	13.2	23.4	12.8	13.8	0.0	14.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

APPENDIX 3

PROGRAM DESCRIPTION

SUB-PROGRAM I

Component 1 - TAP

1. **Name:** TAP - Technology Assessment Panel
2. **Who Responsible:** Federal Government
3. **Total Budget:** $750,000 (includes $ for SEE)
4. **Total Spent:** $598,200 (TAP + SEE)
5. **Program Description:**
   - A. Provides leadership in validating new and existing technologies for Ontario conditions.
   - B. Identifies and provides preliminary assessment of soil conservation technologies re their validity and utility for Ontario agriculture.
   - C. Assess research results from federal, provincial, university and the private sector, as well as, international work.
   - D. As result of the assessments, may recommend technologies for immediate adoption, further evaluation or rejection for use in Ontario.
6. **Contractor:** Herb Norry and Associates, London, Ontario

Component 2 - CIB

1. **Name:** CIB - Conservation Information (Centre) Bureau
2. **Who Responsible:** Federal Government
3. **Total Budget:** $1 Million
4. **Total Spent:** $1,261,568
5. **Program Description:**
   - A. To collect, catalogue, process, store and distribute growing stock of technical data.

B. To assume the leadership role in communicating information on S/W conservation and management.
C. Clientele to include professionals, extension workers and agribusiness.
D. Will address farmers' concerns of difficulty in obtaining consistent, reliable technical information on which to base decisions.
E. Board of Directors, appointed from government, farm organizations and agribusiness, will set up, establish operating policy and procedures and manage the Centre.
F. Centre to be set up on a contract basis with existing educational institution, farm or private sector organization.
G. Centre will work with TAP.
H. Funding provided on a declining scale. Agreement will cover Centre's full cost during 2-year start up period, public sector funding will be reduced each of years 3, 4 and 5, with objective of Centre operating on cost recovery basis by year 6.

6. **Contractor:** University of Guelph

Component 3 - SEE

1. **Name:** SEE - Socio-Economic Evaluation Component

2. **Who Responsible:** Federal Government

3. **Total Budget:** $750,000 (includes $ for TAP)

4. **Total Spent:** $598,200 (TAP + SEE)

5. **Program Description:**

   A. Federal component funds are to support analysis of social and psychological factors involved in adoption of soil management and soil conservation practices and study the potential of various institutional mechanisms to encourage adoption of conservation practices which will reduce soil erosion and degradation.

   B. Will support evaluation studies to determine why farmers adopt or do not adopt conservation technologies and what incentives would most effectively encourage them to do so.

6. **Contractors:** University of Guelph and others

SUB-PROGRAM II

Component 1 - TED

1. **Name:** TED - Technology Evaluation Panel
2. **Who Responsible:** Federal Government
3. **Total Budget:** $6.8 Million (TED + FLEA)
4. **Total Spent:** $6,139,700
5. **Program Description:**
   - A. To develop, test and evaluate new technologies that might be used to address water quality and soil productivity issues and phosphorus movement cropland to water systems.
   - B. To determine suitability, adoptability and economic viability of new technologies for commercial farmers that have high probability for success on commercial farms.
   - C. Activities to address:
     - Conservation cropping, planting and tillage equipment.
     - Soil drainage and integrated pest management related to chemical movement to water systems, under commercial farm conditions with commercial farmers.
   - D. Funding will support development and implementation of individual projects, compensation for co-operating farmers, preparation of reports and communication of results.
6. **Contractor:** Ecological Services For Planning, Guelph, Ontario

Component 2 - FLEA

1. **Name:** FLEA - Farm Level Economic Analysis
2. **Who Responsible:** Federal Government
3. **Total Budget:** $608,259
4. **Total Spent:** $618,700

5. **Program Description:**

   A. Evaluates the economic impact of newly developed SWEEP technologies and techniques.
   B. Establishes a database and develop analysis tools for a realistic economic assessment of conservation practices.
   C. Application to the Pilot Watershed sub-program and TED.

6. **Contractor:** Deloitte & Touche

SUB-PROGRAM III

Component 1 - PWS

1. **Name:** PWS - Pilot Watershed Study

2. **Who Responsible:** Federal Government

3. **Total Budget:** $5.25 Million

4. **Total Spent:** $5,165,300

5. **Program Description:**

   A. Evaluates the effectiveness of implementing soil and water (S/W) conservation practices in selected watersheds. Work closely with TAP Committee. Environment Canada and MOE to simultaneously monitor change in water quality on the watersheds.

   B. Evaluate/demonstrate effectiveness and efficiency of changing soil conservation practices on a watershed to help improve water quality while economically enhancing soil productivity.

6. **Contractors:** Beak Limited
   Ecologistics Limited

Component 2 - Water Quality Monitoring

1. **Name:** Water Quality Monitoring
2. **Who Responsible:** Provincial Government - Ontario Ministry of the Environment
3. **Total Budget:** $500,000 (Funds independent of SWEEP)
4. **Total Spent:** $345,800
5. **Program Description:**
   A. Collecting baseflow and spring runoff water quality data.
6. **Contractor:** Beak and Associates Limited

Component 2 - Water Quantity Monitoring

1. **Name:** Water Quantity Monitoring
2. **Who Responsible:** Federal Government - Environment Canada
3. **Total Budget:** $500,000 (Funds independent of SWEEP)
4. **Total Spent:** $147,700
5. **Program Description:**
   A. The construction and operation of six water quantity/sediment stations.
   B. Provides input to watershed selection criteria and selection of watershed candidates.
   C. Monitoring of rainfall runoff from watersheds within the Pilot Watersheds Study.
6. **Contractor:** Beak and Associates Limited

SUB-PROGRAM IV - Local Demonstrations

Component 1 - T-2000

1. **Name:** Tillage-2000

2. **Who Responsible:** Provincial Government - OMAF

3. **Total Budget:** $1.75 Million (includes Side-by-Side)

4. **Total Spent:** $1,952,000 (includes Side-by-Side)

5. **Program Description:**

   A. Will be introduced in 1985, with OMAF, OSCIA and U. of Guelph cooperating. Select, manage and supervise 30-50 on-farm sites for 3-5 years to demonstrate and monitor the effects of alternative tillage practices and crop rotations and to analyze data generated.
   B. OMAF will implement and accelerate demonstration program to promote wider adoption of proven S/W conservation technology on agricultural lands.
   C. Main thrust on soil and crop management practices, primarily tillage and crop rotations.
   D. Projects mainly located on farms of members of OSCIA.

6. **Delivery Agent:** OMAF

Component 2 - Side-by-Side

1. **Name:** Side-by-Side Demonstrations

2. **Who Responsible:** Provincial Government - OMAF

3. **Total Budget:** $1.75 Million (includes T-2000)

4. **Total Spent:** $1,952,000 (includes T-2000)

5. **Program Description:**

   A. Demonstrations will provide farmers with first-hand information on use of the practice, its benefits, problems, resulting crop yields and the changes in soil structure.

B. Funds provided to local associations for projects and work conducted jointly with local members of OSCIA. These will mostly be side-by-side plots, assisted by technical field staff.

6. **Delivery Agent:** OMAF

SUB-PROGRAM V

1. **Name:** Technical Assistance

2. **Who Responsible:** Provincial Government - OMAF

3. **Total Budget:** $6.0 Million

4. **Total Spent:** $5,207,000

5. **Program Description:**

   A. OMAF is to strengthen its ability to provide field level professional conservation advice with a team approach, including expertise in soils and crops, soil and water engineering and farm management.

   B. Teams will provide each farm cooperator with assessment of soil degradation/erosion problems on subject farm; do crop production and land use planning; advise on most appropriate type of conservation tillage and planting equipment and most appropriate production practices.

   C. OMAF will employ Soil Conservation Advisors to lead the S/W conservation program, and will be strategically located in areas with the most serious soil conservation problems.

   D. OMAF staff will assist farmers in organizing educational meetings at local, district or provincial level as required. These workshops will discuss local soil conservation problems and to assist farmers in finding alternative management practices or cropping strategies.

   E. OMAF will develop and provide more factsheets and other printed material on soil conservation practices.

   F. OMAF staff will assist TAP in developing and evaluating technologies from outside Ontario that appear promising for Ontario.

6. **Delivery Agent:** OMAF

SUB-PROGRAM VI

1. **Name:** Soil Conservation Incentives

2. **Who Responsible:** Provincial Government - OMAF

3. **Total Budget:** $7.0 Million

4. **Total Spent:** $8,171,300

5. **Program Description:**

   A. OMAF will support incentives to reduce phosphorus loadings of water systems by controlling movement of water and sediment from lands intensively cropped.

   B. Grants available to farmers to assist in capital cost of constructing erosion control structures to reduce ditch and stream bank erosion, as well as erosion on agricultural lands. Grants up to $7,500 for 50% of the eligible construction costs will be provided.

   C. Extension advice to be provided by OMAF staff. When structure is satisfactorily completed, the grant will be paid. Grants will encourage farmers to build adequate structures, promote soil conservation, protect the soil and improve water quality.

   D. Part of the Ontario Soil Conservation and Environmental Protection Assistance Program (OSCEPAP II)

6. **Delivery Agent:** OMAF

SUB-PROGRAM VII

1. **Name:** Administration, Monitoring and Public Information

2. **Who Responsible:** Federal and Provincial Governments
   Agriculture Canada and OMAF

3. **Total Budget:** $1.15 (F) and $0.25 (P) Million

4. **Total Spent:** $1,092,800

5. **Program Description:**

   A. The Management Committee is to administer and provide public information on the overall program; it will ensure that each sub-program contributes to the overall soil productivity and phosphorus objectives.

   B. Canada and Ontario will share in supporting the Management Committee in day-to-day planning, monitoring, evaluation, administrative ad public information responsibilities.

   C. Work to be undertaken includes:
   - Investigatory studies;
   - Sub-program evaluations;
   - Preparation of Annual Work Plans and Quarterly Progress Reports;
   - Management co-ordination/integration at the project level in keeping with the objectives of the Agreement and information to the urban and farm public on the nature and consequences of soil and water quality problems and of SWEEP's objectives.

6. **Delivery Agent:** Agriculture Canada/OMAF
   Contractors: Ginty Jocius & Associates/InfoResults Limited